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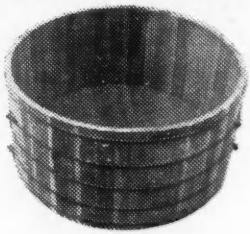

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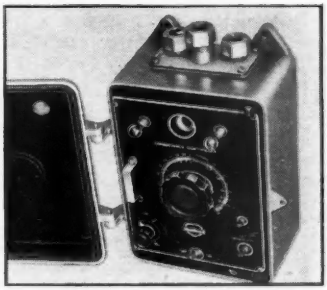

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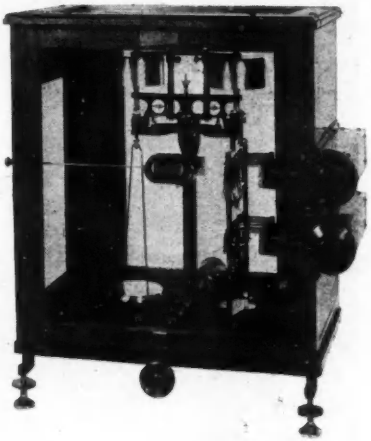

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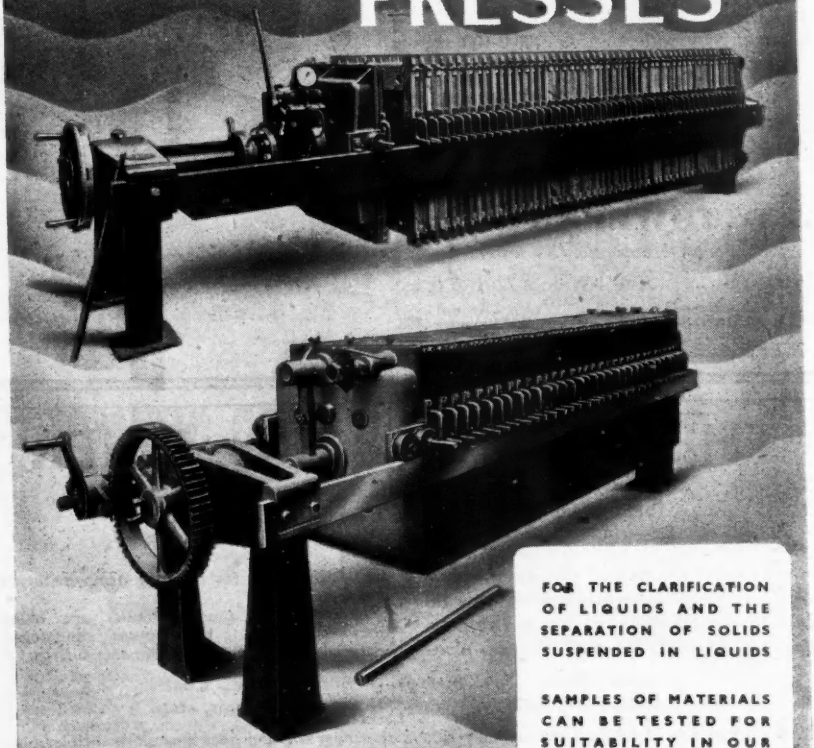

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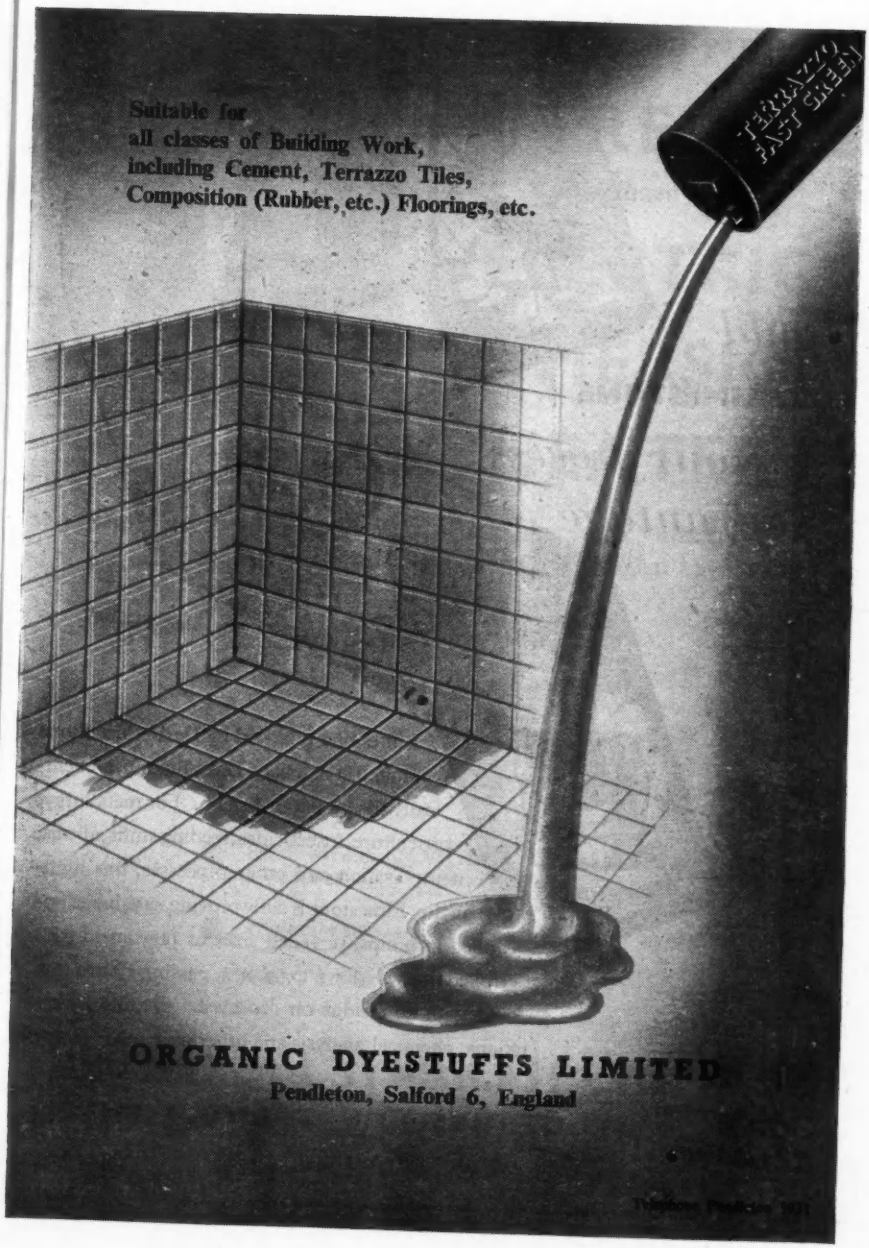
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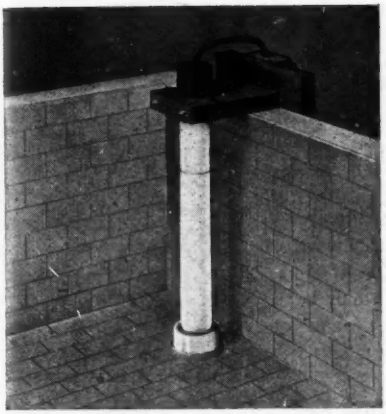

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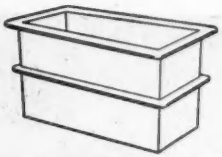

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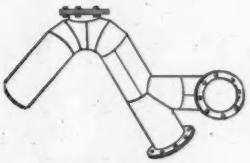

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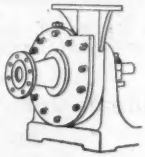

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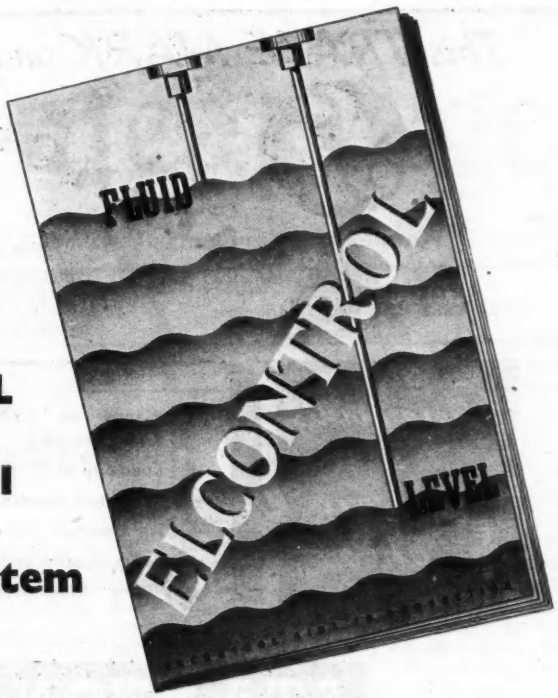

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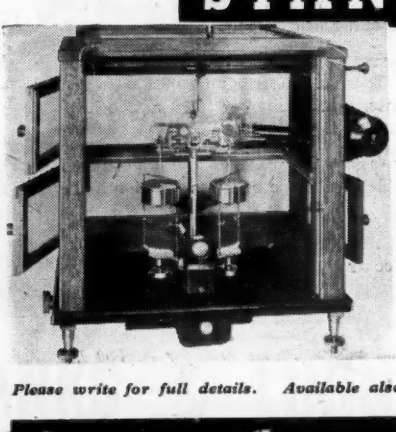

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Volume LXIV 31 March 1951 Number 1655

Incentives in Industry

MANY thousands of words must have been devoted to the subject of incentives in industry during the last few years. As a controversial topic, incentives are dangerously attractive to the idealistic writer and the verbose talker. It is far, far easier to prove that incentive systems of payment are desirable than it is to design and operate one such scheme in one particular factory. Pitfalls abound. An imperfect scheme instead of increasing production may well act as a catalyst for serious labour-management disputes and misunderstandings. The factory manager contemplating an output bonus system should proceed as cautiously as a middle-aged man contemplating belated marriage.

The publication this month of a Ministry of Labour booklet on 'Wage Incentive Schemes' (1951, H.M.S.O., pp. 44, 1s. 6d.) has stimulated this brief addition to the flood of piecework rate and bonus literature. This booklet is not only useful for the information it provides. It shows that a government department—and more especially a Labour Government department—officially recognises incentive methods of payment. There should perhaps have been no doubts on this matter. More than one Minister has spoken with some indication of enthusiasm for a 'payment-by-results' factor in wage packets. However, there has been more than a suspicion that Trades Unions frown upon incentive systems of pay, and industrialists have had plenty of reason to wonder which voice of authority over labour counts the most in the long run. Here at any rate is official support for payment by results. The booklet does not evade the question of Trades Union suspicion. Most of the introductory section deals with the safeguards required 'to protect workers' interests.' It might have been more stimulating to devote the first few pages to the case for incentive payment systems in terms of their actual purpose, the increase of productivity. Many an employer, otherwise eager to find some way in which both wages and output can be increased, will be somewhat discouraged by the array of safeguards. One safeguard in particular, if taken too seriously in A.D. 1951, would turn the entire contents of the booklet into an historical curiosity of no value. It is said that before operating a scheme for payment by results the organisation of the work should be reviewed—'for example, it has been found to be of great importance that materials and work should flow evenly through the establishment . . . delays at any stage of a process may retard the completion of work, affecting the subsequent payment of

bonus, and lead to resentment, etc. . . .' Such idealism could come only from a government department! If managers and employers had to wait until they could ensure an even flow of *materials* through factories before introducing incentive schemes, none of these schemes would be operating in any industry today. The maintenance of material supply is an enigma for capital, management, and labour alike. When it is said earlier in this booklet that 'the operatives who are to work under it (the incentive scheme) should understand its nature and purpose and be consulted at all stages . . .'—a safeguard with which every one who has ever organised an incentive scheme would agree—the possibility that raw material shortages or delays may affect the scheme is surely fully covered. It seems late in the history of industrial relations to give special attention to the fact that bricks cannot be made without straw and that extra pay for making more bricks is unlikely if the amount of straw is reduced.

Although much of the booklet is devoted to describing different systems operated in various industries, it is unfortunate that few details are given of the system most likely to suit the conditions in small and medium sized chemical works. This is the system in which a standard output target per month or per week, *e.g.*, 50 tons or 250 tons, is fixed and an agreed scale of additions to time-work earnings is applied for all workers whenever the target is exceeded. Such schemes are today successfully operated in chemical works as a whole or in departments of multi-activity chemical works. Provided the extra payments are reasonably related to the extra output and its profitability, incentive schemes of this nature have reduced overtime and labour costs per ton, added greatly to factory outputs, and raised the workers' wage levels far more than increases in hourly rate. For the chemical industry, in which so often relatively small labour forces handle materials of high value, these essentially simple incentive schemes are satisfactory to both sides and they have the great merit of holding the works staff together as a team; piecework systems and individual output schemes destroy the team spirit and what is gained in material advantages may be more than lost in less measurable directions. The very fact that an incentive scheme must be clearly understood in every detail of operation by the workers to whom it applies is an argument for simplicity.

The statistics show that chemical factories have been slow in adopting incentive methods. Are the difficulties overestimated? Are too many comparisons made with the mass-producing machine-tooled factories' systems at the expense of much simpler schemes based upon team effort and clearcut measures of output? Chemical factories are different, and should be treated as such.

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Notes & Comments

Unrest in Germany

FOR some months past the editorial pages of *Chemische Industrie* have voiced more or less pungent criticism of allied controls and restrictions on German chemical economy, which, as one of the main foundations of potential military recovery, naturally requires special vigilance. It is only to be expected that this would evoke chafing and impatience. The executive committee of the Chemical Industry Society at a meeting on 30 January passed a strong resolution of protest against the prohibitions and restrictions, especially under Rule 24 of the Allied High Commission. It emphasises that the West German chemical industry is the key to any substantial recovery in export trade and general economic well-being. and could be a powerful link in the military preparedness and commercial and industrial strength of Western Europe as a whole.

'Quousque Tandem?'

IN a leader under the title 'Quousque tandem?' the arguments of the above resolution are amplified, and they are expanded in still further detail in an article by Dr. F. Frowein, of Wiesbaden. The Latin phrase means 'How long, pray?' and our classical readers will doubtless recall the famous question of Cicero: 'Quousque tandem abutere, Catalina, patientia nostra?' (How long, Cataline, will you abuse our patience?). The above rule 24 and additional 'fetters' imposed by other regulations, covering various controls and supervision under present world conditions, have been reduced to absurdity, says the leader writer; and have brought into sharp contradiction political prejudices on the one hand and economic common sense on the other. Among other things, Western Germany is desperately short of raw materials and intermediates in many fields. In common with other countries of Western Europe she must work harder and export more. Most of her attempts to do this, says the writer, are thwarted by a military veto of the AHC (Allied High Commission). There is much more of the same tenor, ending with the sombre reflection that these things are imposed by leading exponents of democratic freedom; while on the other side of the iron curtain in the so-called Democratic German Republic under Soviet control, manufacturing capacity for such things as chlorine, Buna rubber, Fischer-Tropsch products, etc., is utilised to the full.

Limitations Absurd

DR. FROWEIN (*Chem. Industrie* 1951, *3* (3) 116-118) reviews at some length the numerous directives and regulations controlling and supervising the German chemical industry, and more particularly Rule No. 24, based on an agreement of the three occupying Powers of 14 April, 1949. In his view many of the limitations are absurd and indefensible. Chlorine, for example, is among the most important basic raw materials and the potential demand is many times greater than existing capacity. Among other things the 'bottleneck' in paper supplies in Western Germany would be eliminated if chlorine was in adequate supply. It could, however, be remarked here that judging from the size and quality of paper of most German technical journals to-day, including *Chem. Ind.*, paper shortage would appear to be far less acute than in England. Much the same applies to restrictions on other products: phosphorus compounds, styrol, synthetic rubber and its raw materials, synthetic fuels, etc. The author is particularly bitter on the subject of Fischer-Tropsch limitations. Here, as elsewhere, he complains it is not only Germany that is frustrated and seriously impaired: the whole economy of Western Europe and possibly of the world is thrown out of balance and disturbed. Assuming that Germany is seriously expected to play a part in the defence of western democracy—and this appears to be his trump card—why, with blatant inconsistency, undermine her ability to do so? Despite

many meetings and discussions between representatives of the Bund and Allied authorities, and hopes for some easing of controls, nothing in that direction appears to have materialised so far, and the Germans are, with growing bitterness and impatience, still asking the same question: *quousque tandem*?

Definite Plan Needed

WHAT sort of reply can be made? Is it possible for allied control policy to be based on the principle that production should not be controlled or limited in any way, but, on the contrary, stimulated to the utmost; while control should be directed rather to use and destination, to export and markets? The world generally is short of many things, including more particularly those of which production has been drastically limited in Germany. Why not allow her to go ahead and manufacture these to her utmost capacity, but insist on some sort of control on use and export? We might even augment our slender sulphur supplies in this way. We do not think that the American or British chemical industries have any reason to fear German recovery. In many quarters it would be welcomed. No one can blame the authorities for acting cautiously, but it is surely about time that some definite plan was adopted and stuck to. A weak and restless Western Germany is desired only by the Communists.

Sulphur and Fruit

MUCH has been said about the sulphur shortage's effects upon sulphuric acid production and the general consequences of this for the manufacture of chemicals. Far less has been said about one of sulphur's more direct uses—as a fungicide in the fruit orchards. The effectiveness of sulphur has been recognised for over a century, though what had once been learnt in the French vineyards had to be re-learnt before sulphur sprays made a widespread entry into hard fruit growing. For mildew and scab diseases no fungicide has yet excelled the modern sulphur or polysulphide type spray; and many of the new synthetic organic fungicides themselves include sulphur in their molecular composition. An authority upon British fruit growing, a man whose scientific and practical knowledge is nationally respected, expressed the opinion recently that any sharp reduction in the supply of sulphur fungicides will have ruinous consequences for this country's commercial apple and pear production. For this use of sulphur there is no reliable alternative. For acid production there are such substitutes as anhydrite, pyrites, spent oxide, etc. But the fungicides, whether composed of finely dispersed sulphur or of calcium polysulphides, must be based upon the element. It is to be hoped that an enforced drive for finding different fungicides will not be imposed upon this branch of industry and applied research. For many years alternatives have been sought because sulphur-based fungicides are not without their awkward limitations. Certain varieties of fruit suffer from sulphur damage. If better alternative sprays to fight scab attacks could be developed, they would have emerged whether sulphur was abundant or scarce. The seriousness of the position for this country's hard fruit industry will not merely be duplicated in New Zealand and Australia. There it will be felt with an even greater intensity, particularly in the former country whose apple industry relies upon dispersible sulphur sprays more than upon any other factor. Indeed, New Zealand can probably claim to have taken the lead in the modern development of sulphur fungicides for her scientists have made greater progress towards microfine products than British or American scientists. Without sulphur or with less sulphur, fruit production and quality must quickly fall; and methods for storing fruit that are now satisfactory may be found to become less and less reliable.

Chemical Works Purchased

Marchon Products, Ltd., have recently completed negotiations with Messrs. Perry and Hope, Ltd., for the purchase of their Forth and Clyde Chemical Works at Nitshill. This plant will be operated by P. & H. Phosphates, Ltd., a wholly owned subsidiary company of Marchon Products, and will make commercial phosphoric acid, and sodium ortho- and pyro-phosphates.

Technique of Inorganic Microanalysis

Doncaster Chemical Society Hears Lecture

AT a recent meeting in Doncaster, sponsored by the Doncaster Chemical Society, Mr. T. S. West, of the Analytical School of Birmingham University, delivered a lecture on the general technique of inorganic microanalysis. Following is a summary of his lecture:—

The various categories of microanalysis may be roughly split up into three main divisions, based on the amount of sample used in the analysis.

Classification	Wt. of material	Approx. vol. of solution
Semi-microanalysis ..	10-15 mg.	1-10 ml.
Microanalysis ..	1-10 mg.	20 cu.mm.-1 ml.
Sub-microanalysis ..	0.1-1 mg.	0.2-10 cu.mm.

This classification must not be accepted too rigidly, as often a sample of semi-micro size yields an analysis of a minor constituent in the true micro region. A micro-balance should be used to weigh these small amounts of sample, but where one is not available, a good analytical balance may be used by the method of swings.

Historically, microchemistry had its origin in the Austrian city of Graz. Organic and inorganic microanalysis were developed almost simultaneously by Pregl and Emich, respectively, and there is no doubt that they were influenced by each others work.

Difference in Technique

The chemical principles underlying microanalysis are exactly the same as those of macro-analysis, although there is a much wider use of sensitive organic reagents which enable minute amounts of material to be detected and determined. The fundamental difference lies in the technique used to deal with the small amounts of material involved. Normal gravity filtration has to be avoided, as it leads to loss of material, which, though negligible on the macro scale, would lead to considerable error in microanalysis. For this reason the microanalyst employs the centrifuge cone and centrifuge to separate precipitate and liquid in qualitative work. The micro centrifuge cone has a capacity of 0.5-1 ml., and a hand centrifuge is sufficient. Liquids are added from capillary tubing of about 0.5-1 mm. diameter, and stirring is effected by means of a glass thread with a bead at its tip. The precipitate is thrown into the bottom of the cone by spinning in the hand centrifuge, and the liquid withdrawn by tilting the cone and inserting a hair-tipped capillary. The liquid is then blown out into another cone, where further operations can be carried out on it, and the capillary is discarded.

Easily Constructed

Heating of liquids in the centrifuge cone is achieved by suspending the cone from a wire frame into a beaker of hot water, or by placing in the orifice of an inverted cone mounted on a beaker of boiling water. Where gaseous reagents such as H_2S are employed, a very fine capillary tip must be used to introduce the gas into the cone, otherwise the liquid may be blown out. Solids may be transferred on micro spatulas which are the exact counterpart of the spatula, but a solid glass rod finely drawn out, with a bead on the end is more generally used. The bead of the transference rod is moistened by breathing on it, and then touched against the finely powdered solid. Evaporations can be carried out on a microscope slide by waving above a gentle micro flame, but it is preferable to use a glass spoon. These can be very easily constructed[1] by the average student.

Many forms of gas-testing apparatus have been devised. The hanging-drop cell, consisting of two microscope slides separated by a glass cylinder with ground glass edges, is very popular. The test, in which the gas is evolved, is carried out in the bottom slide inside the cylinder, and a drop of the test liquid is suspended from the nether side of the upper slide. Colour tests are carried out on filter paper, or on a spot plate, one half of which should be painted black to facilitate the observation of white precipitates, etc. Most of the apparatus necessary for qualitative analysis, except the centrifuge, can be made by the student himself.

In qualitative work it is essential to avoid the pouring of liquid from one vessel to another wherever possible, and the ideal

[1] Belcher & Wilson, 'Qual. Inorg. Analysis', Longmans, Green & Co. (1946) 13.

object is to perform all operations—solution of sample, deposition of precipitate, and filtration—in one vessel. As a result, gravity filtration is never employed, but inverted filtration takes its place. The devices used in inverted filtration are collectively known as filter sticks. Two filter sticks which involve the use of small discs of filter paper are the King and Miller sticks. The filter stick is placed in the liquid from above, and the liquid is removed by applying gentle suction from a water pump. The paper disc is extruded into the crucible in which the preparation was carried out, and ignited.

Types of Filter Stick

The sintered glass filter stick is used analogously except that filtration is performed on a glass sintered plate. This stick is used where precipitates do not have to be ignited. It is weighed with the preparation beaker, removed during filtration, and reweighed with the beaker and precipitate after removal of the filtrate and wash liquid. The Emich filter stick is a porcelain counterpart of the glass stick, with a porous porcelain plate as the filter. This stick is used in conjunction with a porcelain crucible and may be strongly ignited.

The Neubauer filter crucible is an even simpler device, consisting merely of a small porcelain crucible of about 1 ml. capacity with an unglazed porcelain base. The filtrate is removed through the base of the crucible. A platinum crucible with a sintered platinum base can be obtained for dealing with materials which cannot be handled in porcelain ware.

Perhaps the neatest of all these filtration devices is the Schwarz-Bergkampf filter-beaker. Shaped like a teapot, this vessel has a sintered glass plate let into the spout, and the material to be analysed is introduced through the neck which corresponds to the teapot handle. Filtration is performed by tilting the liquid into the spout and applying suction. A composite series of determinations may be carried out by using a train of these beakers joined head to tail, removing the filtrate from one beaker into the body of the next, and carrying out the deposition of the second precipitate there, etc.

The only filtration method used in micro-analysis which closely resembles macro filtration is the use of the Pregl filter-tube. This last is a miniature Gooch sinter crucible with an elongated stem at the base and a narrow neck at the top. Material to be filtered is siphoned in through the top by applying suction to the lower end of the tube. In that it involves transference of material from one vessel to another, this procedure is perhaps the least satisfactory of all the filtration methods employed in inorganic microanalysis.

The micro-desiccator in which hot pieces of apparatus are cooled consists of a metal block suspended in the middle of a jar with a tightly fitting glass lid. No desiccant is employed, and cooling occurs very quickly.

Micro-gravimetric apparatus is never handled except with forceps, or when necessary, chamois leather gloves. A careful wiping procedure with wet and dry chamois is used, and a standing time observed to ensure dispersal of static charges on the glassware.

In micro-volumetric work the desired reduction in scale is achieved by using micro volumes and also by reducing the strength of the reagents employed. Where a reaction is too sluggish in dilute solution very small micro-burettes such as the micrometer syringe variety are used, but generally the use of a larger burette and more dilute reagents is to be preferred.

When the titration is to be done in a narrow vessel such as a centrifuge cone gas stirring from a very fine capillary is employed, and where a more open vessel is used, magnetic or mechanical stirring from a small air turbine. A feature of the smaller type of burette is that they are tapless, the flow of titrant being controlled by capillary action. In any titration the minimum amount of liquid that can be delivered by the burette is limited by the size of the drop formed at the burette tip. To overcome this limitation micro-burettes are always used with the tip immersed below the surface of the titrant, but prevents any appreciable exchange of liquid between that outside and inside the burette tip.

Microburette Principles

Normal indicator methods are used, and also potentiometric, conductometric and amperometric titrations are employed using micro-electrode systems.

There are three main types of microburette. Firstly the tapless variety may be characterised by the Benedetti-Pichler burette. This consists of a long uniform thermometer type capillary tube, mounted horizontally on a board which pivots vertically. A millimetre scale is positioned

behind the tube to enable burette readings to be taken. The end of the burette is bent upwards at right angles to the main tube, while the delivery end points vertically downwards with the tip so adjusted that when immersed, with the main tube of the burette in the horizontal plane, a flow rate of 15 mm. per min. is observed. The overall length of the burette should be about 30 cm. and the diameter approximately 2 mm. The burette is filled by immersing the tip and tilting backwards, and delivery is effected from a horizontal position. The titration is stopped by removal of the tip from the liquid. Titration figures are not recorded in terms of actual volumes, but rather in mm., *i.e.*, the distance through which the meniscus in the burette travels during the titration. For example, to titrate an unknown alkali, the burette is filled with an acid and equal volumes of the unknown and a standard alkali of approximately the same strength are delivered into two micro-beakers from a micro-pipette whose volume need not be known; these are then titrated with the acid. If L′ is the length recorded for the unknown, and L″ that for the standard alkali of strength N″, then N° the strength of the unknown is given by

$$N^\circ = N'' \times \frac{L'}{L''}$$

Micrometer syringe burettes work on much the same principles, except that the propelling power is supplied by the micrometer, which is also used to measure the amount of titrant delivered.

The Winteringham burette has a capacity of 1 ml. and can be simply constructed from apparatus found in the average chemical laboratory. The control of the flow of titrant depends on the rise or fall of a mercury column. The main feature of the burette is that a coarse or fine control can be used. The mercury column is fed from an adjustable system by means of a fine or wide bore tube and a two-way glass tap. The wide bore tube is used to fill the burette and the fine one for controlling the titration.

Hand Bellows Feed

The larger type of micro burette differs little from the corresponding macro burette. A typical burette in this category is that of Pregl. It is mounted by a ground glass joint on top of a bottle containing the titrant, and liquid is fed into the burette by the action of hand bellows. The delivery tube in the top of the burette acts as a siphon, and brings the zero automatically to hand. This type of burette usually has a capacity of 5-10 ml.

All glassware used in micro-volumetric work must be thoroughly clean, and it is usual to soak it in chromic acid immediately before use. As in all fields of microanalysis the small amounts of material used makes it practicable to employ reagents which would normally be too expensive, and the neatness of micro technique leads to a better response from many students who normally are careless and untidy workers.

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Unique Penicillin Compound

FOR the first time in the history of penicillin therapy a compound has been developed that has a marked selectivity for one particlar organ of the body. This new drug—Estopen—which has recently been placed on the market by Glaxo Laboratories, Ltd., possesses the unique property of concentrating penicillin action in the lung and bronchial tissues.

The conception of penicillin derivatives having affinity for particular tissues or organs is not new but this is almost certainly the first instance where the investigations have shown practical results. The new compound was discovered in the course of an investigation for a new 'prolonged action' penicillin derivative.

Clinical data so far available have shown that administration of Estopen has given concentrations of penicillin in the lung tissues far in excess of those obtained with similar doses of the conventional forms of pencillin.

Estopen is the hydriodide of the diethylaminoethyl ester of penicillin G. It is a dry powder with suitable buffering and suspending agents and is issued in single-dose vials of 500,000 units. It has a molecular weight of 562 and a low solubility in water.

The usual dose is 500,000 units once or twice daily increased to 1,000,000 units in more severe cases. Estopen has a low toxicity, approximately the same as that of procaine penicillin, and accordingly negligible in normal clinical use.

The new compound has shown marked advantages in treating a variety of penicillin-sensitive infections of the lungs, pleura and bronchi; in particular bronchitis (both chronic and acute), bronchiectasis, pulmonary abscess, and pneumonia.

Coal Shortage in Germany

Chemical Production Curtailed

AFTER a slight production increase in January, most West German chemical manufacturers have had to curtail operations again in February and March owing to reduced coal deliveries, and even the leading companies have not escaped unscathed. The coal allocation for Farbwerke Höchst, for instance, was cut by as much as 38 per cent, while about the middle of February Farbenfabriken Bayer, Leverkusen, began to reduce operations in some sections.

To try and overcome its shortages Badische Anilin- und Sodafabriken, Ludwigshafen—with a normal coal consumption of one million tons a year—made arrangements for imports of U.S. coal, some of which was to be carbonised in the Low Countries so as to meet the company's coke requirements for the production of nitrogen.

Fertiliser Problems

Despite enforced production cuts, the fertiliser industry increased its stocks, with the exception of basic slag, production of which suffered from reduced activity in the iron industry, during the past few months. Calls from agriculture have only lately begun to improve. Shortages of bags, transport difficulties and other factors are creating additional problems for West German fertiliser producers.

Producers of artificial fibres report a satisfactory volume of production. Phrix-Werke AG which last year started the production of transparent foils under the trade name of 'Phriphan' at a daily rate of 1.5 tons are extending this production. This company has also been able to solve its coal problem with the assistance of U.S. customers. It intends to go ahead with the commercial utilisation of a new fully synthetic fibre—Phrilon—derived from furfural by a process designed by Strohzell-AG, Neumünster, a Phrix subsidiary. The new fibre is said to be suitable for various textile purposes, singly or with other fibres.

A new battery of 25 double coke ovens has been put into operation at the Dahlbusch colliery in the Ruhr, raising the daily coke output from 1,000 to 1,350 tons. Production began a few months ago at the new fatty acid plant of H. Wilhelm Schaumann at Uetersen, Holstein.

Nitrophosphate Fertiliser

MANY companies have been attracted by the possibilities of using nitric acid instead of sulphuric acid for the extraction of phosphate rock. Operation of the ordinary superphosphate process, replacing sulphuric with nitric acid, is unsatisfactory however, because of the hygroscopic compounds such as calcium nitrate produced in the reaction. Work on nitric acid processes has been carried out by Imperial Chemical Industries at Billingham intermittently since about 1929 and during the last few years it has been possible to obtain a granulated produce of satisfactory physical properties.

The analysis of the product is as follows:

Total P_2O_5 content	15.4%
Citric acid soluble P_2O_5 content	12.7%
Nitrogen content	12.7%
Water content	2.0%

Imperial Chemical Industries' Nitrophosphate is made by the extraction of phosphate rock under suitable conditions with nitric acid. Ground Morocco phosphate rock and a solution of 50 per cent nitric acid, in somewhat less than theoretical proportions, are mixed together in a corrosion-resistant steel reaction vessel in order to convert the P_2O_5 content of the phosphate rock into monocalcium phosphate. The reaction to this stage may be expressed simply by the equation:—

$$Ca_3(PO_4)_2 + 4HNO_3 = Ca(H_2PO_4)_2 + 2Ca(NO_3)_2.$$

The presence of calcium nitrate in a fertiliser is undesirable because of the avidity with which it absorbs moisture from the surrounding atmosphere, a solid fertiliser soon changing into a fluid mass. In order to remove calcium nitrate from the nitrophosphate the reaction product is treated with ammonia and ammonium sulphate according to the following equations:—

$$Ca(H_2PO_4)_2 + Ca(NO_3)_2 + 2NH_3 = 2CaHPO_4 + 2NH_4NO_3 \text{ and}$$

$$Ca(NO_3)_2 + (NH_4)_2SO_4 = CaSO_4 + 2NH_4NO_3.$$

The resulting material is dried and the granules formed are screened and bagged. The product consists of hard, stable granules with good storage properties. Extensive field trials are in progress this season and a pilot plant is being built at Billingham.

Editor's Note: A paper on nitric acid fertiliser manufacture was read to the Fertiliser Society by Dr. M. H. R. J. Plusjé on 15 February, 1951. CHEMICAL AGE, 24 February, 1951.

Properties of Urethane Oils

Need for Further Investigation

DEVELOPMENT of the urethane oils both in this country and abroad was the subject of a paper presented by Mr. E. B. Robinson and Dr. R. B. Waters at a recent meeting of the London Section of the Oil and Colour Chemists' Association. Mr. L. O. Kekwick, chairman of the section, presided.

In the course of the work in Germany during and before the war, aimed mainly at reducing dependence on imported materials, there was great activity in the polymer field, and much work was done on the urethane reaction.

The fundamental reaction of an isocyanate with an alcohol to form a urethane was discovered by Wurtz in 1848. The combination was effected by transfer of the hydrogen of the hydroxyl to the nitrogen of the isocyanate. But the reaction was not limited to the hydroxyl groups, other groups having a hydrogen atom replaceable by sodium, such as the amino group $-NH_2$, the carboxyl group $-COOH$, and so on, would react with isocyanates.

By using polyfunctional reactants, that is by reacting compounds containing two or more diisocyanate groups with compounds containing two or more hydroxyl groups, it was obviously possible to build up polymeric materials. That fact, and the superior resistance of the urethane link to hydrolysis compared with the ester link, had led Bayer, of the I.G., to investigate the possibility of using that reaction to effect improvements in the properties of drying oils.

Work Carried out in U.K.

Work on the urethane reaction was carried out in Germany, in England and in America. There was a British patent (No. 565,777) covering, among other things, the reaction of drying oil mono- or diglycerides with polyisocyanates, the application date of which was 1942.

Early work in Germany was carried out with linseed oil and trimethylolpropane as the polyhydric alcohol. There was an acute shortage of glycerol at the time, but glycerol was examined, as were other polyhydric alcohols.

Several diisocyanates were investigated and gave quite different results. Aromatic diisocyanates gave better results than aliphatic compounds. The best results were obtained using 1-chlorophenylene 2-4-diisocyanate.

Other oils in addition to linseed oil were examined and fair results were obtained with semi-drying oils. Soya bean oil gave a product with good drying properties.

From the wide claims that were made it appeared, to quote B.I.O.S. Report 628, that the urethane oils were likely to be of great interest to the paint industry and would probably represent the most important advance since the introduction of alkyd resins.

Properties Examined

A considerable amount of work had been carried out to investigate those claims. In the first series of experiments a number of urethane oils were prepared by the methods developed in Germany from dehydrated castor and linseed oils. Hexamethylene diisocyanate and chlorophenylene diisocyanate were used. The authors discussed the preparation of the glycerides and their conversion into urethane oils, and lists were given of the products made and of their properties.

Of those products, those made from chlorophenylene diisocyanate were oils having normal appearance; those made from hexamethylene diisocyanate, however, set to a firm jelly on cooling, and some particulars were given of their dilution by means of white spirit.

Urethane oils derived from dehydrated castor oil were unstable and tended to gel on storage. That was probably due to the presence of hydroxyl groups in the fatty chains resulting from incomplete dehydration of the castor oil. Those would react with the diisocyanate and form a cross-linked system. The most stable of the dehydrated castor oil samples was, as would be expected, that containing the least amount of diisocyanate, but that gelled within eight weeks of manufacture.

It was possible that the inferior results obtained with hexamethylene diisocyanate resulted from incomplete reaction of the isocyanate with the glycerides, since that

diisocyanate was less reactive than chlorophenylene diisocyanate. That theory was unlikely, however, in view of the stable nature of the products.

Cross Linking Theory

Some reaction other than that at the hydroxyl groups probably occurred when a diisocyanate reacted with a mixture of glycerides. That reaction might occur at some point in the unsaturated portion of the oil molecule and thus lead to cross linking.

The urethane oils produced were compared in a series of finishes, clear and pigmented, with orthodox linseed oil modified alkyd resins. Of the dehydrated castor oil products, only that containing the least isocyanate was stable sufficiently long to examine in any detail. The peculiar viscosity characteristics of the hexamethylene diisocyanate products rendered them difficult to evaluate as orthodox coating compositions, but they were all decidedly inferior in drying properties, film hardness and water resistance to the chlorophenylene diisocyanate products.

In drying properties the urethane oils gave much better results with a tri-metal drier combination of lead, cobalt and manganese than with cobalt alone. They had a similar degree of water and alkali resistance to the alkyds; resistance improved with increasing diisocyanate content. Brushing properties were slightly inferior to the long oil alkyd. All the urethane oil finishes showed rather poor flow.

Following these investigations, it was decided to make a series of urethane oils based on linseed oil mixed glycerides using 50, 75, 100 and 125 per cent of the theoretical quantity of chlorophenylene diisocyanate and also, in an attempt to improve the flow properties, a series of products based on stand oil.

Of those products, those made from stand oil with 100 and 125 per cent theoretical usage of diisocyanate gelled before testing and those with 75 and 50 per cent were not outstanding in properties, although they gave the expected improvement in flow.

As with the previous series of urethane oils, it was found that drying speed and resistance properties improved with increasing diisocyanate content. In the linseed oil series 100 per cent theoretical usage of diisocyanate was sufficient to give a product rather superior to a high class alkyd in drying speed, film hardness and water resistance. The main defects of the oils were again poor colour, increased after-yellowing and inferior flow.

All the samples so far tested had shown a tendency to increase in viscosity on storage, and it seemed possible that the reaction of the 'glyceride' with the diisocyanate was not so complete or so quick as had been believed. A set of products was made, therefore, in which the reaction was continued until, by analysis, the free chlorophenylene diisocyanate was reduced to less than 0.75 per cent. That required 2-6 hours at 100° C.

In addition, the effect of using linseed oil fatty acids and sodium glycerate as alcoholysis catalysts in the preparation of the glyceride was examined, and, in an attempt to improve colour, the effect of using distilled diisocyanate (97 per cent purity) in place of the quality previously employed (91.5 per cent purity). All the samples were based on alkali-refined linseed oil.

Satisfactory stability was attained, but the general properties of the products confirmed the previous results. Purification of the chlorophenylene diisocyanate had little effect on the properties, and the comparable products made with linseed oil fatty acids and sodium glycerate as alcoholysis catalysts were very similar in behaviour.

At that stage the first durability results became available on the first set of urethane oils made. They had been exposed as clear varnishes, as white enamels pigmented with a mixture of equal parts of titanium white and Timonex to a pigment/gum ratio of 1.25/1, and as white enamels pigmented with a zinc oxide/titanium dioxide 9/1 mixture to a pigment/gum ratio of 1.5/1. They were exposed in a country situation at an angle of 45° facing south.

Durability Comparatively Poor

Durability of the clear urethane oil varnishes was poor compared with that of alkyd varnishes. The colour retention of the oils was rather poor, as expected. In finishes pigmented with titanium white and Timonex the oils showed much better resistance to checking and cracking than in clears, and after 30 months' exposure the best of the oils were as good as the best of the alkyds in that respect.

The urethane oils, however, were decidedly inferior to the alkyds in gloss

retention, chalking and colour retention. Loss of gloss and cracking soon occurred in urethane oil finishes pigmented with zinc oxide.

Tests were made on further samples of urethane oils, including black and brunswick green finishes; in those colours also, the oils showed similar resistance to cracking to the alkyds, but inferior gloss retention. The urethane oils pigmented with brunswick green also showed very marked blueing.

In view of the published German claim for outstanding durability, these tests were disappointing.

From the work so far described the authors concluded that, by reaction of chlorophenylene diisocyanate with linseed oil glycerides, urethane oils might be made which were similar in drying rate, resistance and general properties to a first class linseed oil-modified pentaerythritol alkyd, but which had poor colour characteristics, inferior flow and inferior durability.

To test the point that, by means of the urethane reaction, a rapidly drying product could be made from a semi-drying oil, a urethane oil was made from a mixed glyceride derived from soya bean oil, using the theoretical quantity of chlorophenylene diisocyanate.

Brief reference was made to the results obtained with the product, the properties of which were at least as good as the best of the linseed oil urethane oils. However, there was fairly quick yellowing. No detailed work has yet been done to prepare a stable urethane oil from soya bean oil.

Results Disappointing

Although the results on urethane oils had so far proved rather disappointing, concluded the authors, the field had not yet been fully explored. New di- or polyisocyanates might give better results which would justify the necessarily rather high cost of such compounds.

Applications of the urethane reaction to the paint and allied industries is not, of course, confined to the manufacture of urethane oils. The reaction was one of the most interesting developments in resin chemistry of recent years, and should lead eventually to the production of a number of materials of outstanding interest to the surface costing industries.

The subject was then opened for discussion, the first point being raised by Mr. H. A. Newnham, who asked whether any attempt had been made to use the soft oils, and then to introduce some of the missing properties by blending with other standard varnish-making ingredients, which presupposed that the urethane oils had good compatibility with orthodox type varnishes. If we ever got to the point where these oils became of commercial interest, it should be remembered that compatibility was one of the very big problems in the paint-maker's art.

Compatibility the Same

Dr. Waters, in reply, said that long and careful work had not been done on compatibility, but the urethane oils were, generally speaking, compatible in the same way that orthodox stand oils were. A hard resin varnish could quite readily be made if it were desired although he could not see why anybody should want to do that. The things which were obvious to any paint technologist had already been tried; for instance it was thought that some use might be found for the materials that gelled, in that they might stop the paint settling. That held the pigments up, but no better than a bit of asbestocene, and it was very much more expensive. Aluminium paint had also been considered, but while it made a good one, it was no better than could be made with a decent low-acid-value alkyd and was more expensive.

Asked whether any work had been done with raw castor oil and the diisocyanates the doctor said it had not, but to the best of his belief, if one related raw castor with any quantity of diisocyanates it would gel. Tung oil had been tried, although not by the authors; he understood that the reactions between tung oil and hexamethylene had been tried and it was found that a quick-drying product could be obtained and a quick-drying varnish could be produced, but with shocking durability.

The urethanes were originally prepared by the Germans as stabilisers for nitroglycerine, to reduce acidity, commented Mr. J. Levy, and he was puzzled as to why there was still acidity in the oils after reaction with urethane. Mr. Robinson replied that the acidity was very low and he assumed that the reaction needed pushing a long way in order to bring the acidity to zero.

Mr. W. Rubin asked if it were possible that the yellowing was associated with the nitrogen-containing part of the molecules.

If they wanted to eliminate nitrogen they would probably have to introduce some water elimination during the reaction. With regard to the viscosity of the hexamethylene in relation to the brushing properties, and the fact that on standing there was a tendency to gel, he suggested that it might be dispersed by vigorous agitation.

Associated with Nitrogen Chain

Yellowing properties were definitely associated with the nitrogen chain, in the opinion of Dr. Waters, who added that the benzine ring might have something to do with it. It was not entirely due to the chlorine, because various products which did not include chlorine tended to yellow. However, if they eliminated nitrogen they would no longer have a urethane oil but would be back with an alkyd. Not only the hexamethylene, which had the peculiar tendency to gel, but all the urethane oils produced tended to brush badly. The gel obtained with the hexamethylene was rigid, and when it was stirred it just broke up; it was rather friable.

An indication of how the iodine values ran with the urethane oils as compared with some of the alkyds and some of the normal conventional type oils was asked for by Mr. H. Reynolds. He had done a little work with different types of media and to some extent had connected blueing with iodine value.

The authors had not determined the iodine values alone, answered Mr. Robinson, but he believed the Germans had stated that the iodine was unchanged. Dr. Waters added that the relationship between blueing and iodine value was new to him. If further work showed it up he would have no doubt that it was at any rate part of the explanation of the blueing of the finishes, for he was quite sure their iodine value was very high.

Mr. H. A. Newnham asked if the authors had a theory as to why the durability was so low. Dr. Waters said that he, personally, attributed the poor durability to the fact that the system oxidised throughout. He doubted, however, whether there was any evidence to prove that.

There was another point about durability, added Mr. Robinson, which might also be tied up with the yellowing; it was that the nitrogen centres were always weak except when they were combined with U.F. resin or something like that.

That there might be a common reason for the bad colour and yellowing as well as for the poor stability of the urethane oils was suggested by Dr. O. Liebermann. He had in mind the carbon group attached to the nitrogen atom in a linseed ring which would lead to some discolouration. It was also due to the atmosphere in conjunction with pigments which might change very badly. The nitrogen atoms forming a link in the chain would be the weakest part of the structure. Dr. Waters agreed that both the yellowing and the poor durability were to some extent attributable to the nitrogen link, and that generally speaking the nitrogen link tended to be a weak one.

No figures for permeabilities were in his possession, stated Dr. Waters, but on the ordinary sort of test by immersing a film in water and examining it, the water-resistance was generally of the order of that of a long oil pentaerythritol alkyd. In other words, it was neither bad nor outstandingly good, but was better than the orthodox long oil glycerol alkyd. A well-reacted urethane oil had reasonably good water-resistance, but it was not up to that of a tung oil varnish.

Some figures by Bayer on films which apparently were five days old and had been immersed in water for one day were, however, mentioned by Mr. Robinson. The percentage swelling of the urethane linseed oil was 3.5, the linseed stand oil 11.0, and the tung oil was 4.

Mr. W. T. C. Hammond said Bayer had stated that urethane oils were very stable to basic pigments, and also claimed that the additional small amount of isocyanate added to the stand oil pigmented with zinc oxide prevented the livering which otherwise occurred.

Livering Avoidable

Paint made from zinc oxide was very stable, replied Dr. Waters, and if one made urethane oil, which also was very stable, and then pigmented with zinc, there would not be any livering.

A vote of thanks to the authors was proposed by Dr. S. R. W. Martin, who commented upon the difficulty experienced in obtaining some of the information; nevertheless, the paper was extremely useful. Anyone who had read how isocyanates were made would know that, because of the processes and the plant required, it was quite beyond the average paint technician or small firm to make and investigate them.

Students Entertain Industrialists

Birmingham University Chemical Engineering Society Dinner

THE Chemical Engineering Plant Industry was the theme of this year's annual dinner of the Birmingham University Chemical Engineering Society and Student Section of the Institute of Petroleum, held on 13 March. Guests of honour were E. F. E. Howard (chairman of the Council of British Manufacturers of Petroleum Equipment) and Major V. F. Gloag, M.C. (chairman of the British Chemical Plant Manufacturers' Association).

Among those present were Sir Raymond Priestley (vice-chancellor of the University), Professor F. H. Garner, O.B.E., and Professor Frank Morton (Department of Chemical Engineering), C. A. P. Southwell, M.C. (president, Institute of Petroleum), J. Ronca, O.B.E. (president, Institute of Fuel), and a number of representatives of the chemical and petroleum industries.

Professor F. H. Garner, in proposing the toast of 'The Chemical Engineering Plant Industry,' said that it was in Birmingham that Dr. Roebuck erected the first lead chambers for sulphuric acid manufacture in place of the large glass tubes used elsewhere. That transition from glass to lead was also the transition from the chemist to the chemical engineer. The change from the seen to the unseen, combined with an increase in manufacture, brought design problems connected with heat transfer, fluid flow, and pressure drop, and so mathematics inevitably became part of the chemical engineer's training.

Must be Based on Knowledge

Plant design must be based on a knowledge of both materials and of methods of fabrication, continued the professor. There would certainly be a large expansion in the manufacture of chemical and petroleum engineering plant in the U.K. to meet our own and also export needs. There had been, in the past, too much reliance on processes and equipment developed overseas, largely due to the relatively small proportion of university-trained technologists and to some belief that a career in applied science was inferior in status to other professors. As Sir Ewart Smith had said: 'It may well be said that this country spends much effort in research for others to reap the benefit in application.'

Coupling the names of Major Gloag and Mr. Howard with the toast, Professor Garner said that the BCPMA, which Major Gloag represented, had done a great deal to foster chemical engineering education in the U.K. and he hoped the Association would later produce cost figures on plant design which would put Britain in a similar position to the U.S.A., where such data are readily available.

A Happy Augury

Mr. E. F. E. Howard, responding to the toast, said he felt that it was a happy augury that the names of Major Gloag and himself, and hence the associations they represented, had been coupled with the toast. It indicated the awareness of the Society of the increasing degree of collaboration taking place between the chemical and the petroleum industries, who daily handled similar problems using similar plant and equipment.

The plant and equipment were designed and made to meet the needs and requirements of the chemist and the engineer or, as was fortunately the case today, the chemical engineer. It was obviously in the interests of the manufacturers to have their wares so placed as to enable those whose job it might well ultimately be to specify or operate it, to get to know it during their period of instruction and training.

By providing universities and technological institutions with suitable equipment manufacturers could therefore play their part and even further their own ends. Thanks to the interest taken in this matter by the Institute of Petroleum something had already been done in this respect and hopes ran high that still more could be achieved.

They would, however, appreciate that even manufacturers had their problems which could be considerably alleviated by using standards which existed. Much valuable work was being done by the British Standards Institution in collaboration with industry in producing new standards for the plant and equipment which they would be using, but these specifications were only of value if they were used. He therefore suggested that they would be helping themselves by considering the 'other man's' problems and so retaining a sense of proportion in addition

to all the other very necessary attributes.

Major V. F. Gloag said that to-day a design chemical engineer needed to have a thorough grounding in theory and its practical application, and had to be a leader of men, a leader in science, and often a leader in finance. Chemical engineering was a science of its own and in fact was almost an exact science, but it could only be applied through practical experience.

Birmingham, continued the major, had a fine reputation for producing chemical engineers. He wished to impress on the students that there were probably more prizes to be won in the chemical engineering world than in any other sphere. However, it meant hard work and application.

Mr. C. A. P. Southwell, proposing the toast of 'The Society' said that it had been a far-seeing and courageous act to transform the old petroleum course into one on chemical engineering. His views must be influenced by his own experience in the petroleum industry, but they had a wider horizon, as chemical engineers were needed in most modern industries. However, he hoped that the department, which was started with funds provided by the petroleum industry, would maintain its main association with that industry.

Mr. G. A. Lee (chairman of the society), responding to the toast, reported that the society had had a successful year and particularly asked the guests to support their magazine, the *Birmingham University Chemical Engineer.*

A demonstration of crop spraying by fixed-wing aircraft was staged on 20 March at Boston Airfield, Lincs., by Messrs. Aerial Spraying Contractors, Ltd., in collaboration with Auster Aircraft Ltd., and Shell Chemicals, Ltd. Messrs. Aerial Spraying, Ltd., have recently completed a contract for the protection of cotton crops in the Sudan; this was one of the biggest aerial spraying operations yet undertaken outside North America by fixed-wing aircraft. Agricultural experts of the Royal Dutch/Shell Group who made a major contribution to the project were among the pioneers in this method of crop protection. The picture is a close-up of the Auster Aiglet aircraft showing port section of spray bar and nozzles by which the insecticide is distributed. At the bottom at right can be seen the propeller driven pump. *(by courtesy Shell Chemicals Ltd.)*

The Chemical Society's Anniversary

Professor Adrian Presides Over Distinguished Gathering

THE 1951 anniversary meetings of the Chemical Society were held at Burlington House, London, on 20-21 March. At 4 p.m. on Tuesday Professor E. K. Rideal, M.B.E., M.A., D.Sc., F.R.S., the president of the Society, delivered his presidential address entitled 'Concepts in Catalysis—the Contributions of Paul Sabatier and Max Bodenstein' at Burlington House. This was followed by a reception and conversazione at 6.30 p.m. On Wednesday the 110th annual general meeting took place at 11.30 in the Society's Meeting Room, and at 7 p.m. a reception and dinner was held at the Savoy Hotel.

At the annual general meeting the following elections of the Council were declared:—

Vice-Presidents: Professor G. R. Clemo, Professor D. H. Hey, Professor M. Stacey.

Honorary Secretaries: Professor E. D. Hughes, Dr. L. E. Sutton.

Members of Council: Professor Wilson Baker (Bristol); Dr. J. Bell (Glasgow); Dr. H. M. Powell (Oxford); Dr. H. N. Rydon (London); Professor C. W. Shoppee (Swansea); Dr. J. W. Smith (London); Dr. T. S. Stevens (Sheffield); Professor A. R. J. P. Ubbelohde (Belfast).

Mr. R. P. Bell (Oxford) has been appointed an additional Ordinary Member of Council under Bye Law 19.

The complete list of the new Council is as follows:—

President: E. K. Rideal, M.B.E., M.A., D.Sc., F.R.S.

Vice-Presidents who have filled the office of President: F. G. Donnan, C.B.E., D.Sc., LL.D., F.R.S.; Sir Ian Heilbron, D.S.O., D.Sc., LL.D., F.R.S.; Sir Cyril Hinshelwood, M.A., Sc.D., F.R.S.; W. H. Mills, M.A., Sc.D., F.R.S.; Sir Robert Robinson, O.M., D.Sc., LL.D., F.R.S.; N. V. Sidgwick, C.B.E., D.Sc., LL.D., F.R.S.

Vice-Presidents: G. R. Clemo, D.Phil., D.Sc., F.R.S.; J. W. Cook, D.Sc., F.R.I.C., F.R.S.; D. H. Hey, Ph.D., D.Sc., F.R.I.C.; R. P. Linstead, C.B.E., M.A., D.Sc., F.R.S.; M. Stacey, Ph.D., D.Sc., F.R.S.; W. Wardlaw, C.B.E., D.Sc., F.R.I.C.

Treasurer: Sir Wallace Akers, C.B.E., B.A., D.Sc., F.R.I.C.

Secretaries: H. Burton, Ph.D., D.Sc., F.R.I.C.; E. D. Hughes, D.Sc., F.R.I.C., F.R.S.; L. E. Sutton, M.A., D.Phil., F.R.S.

Ordinary Members of Council: J. S. Anderson, M.Sc., Ph.D., A.R.C.S.; G. Baddeley, M.Sc., Ph.D.; Wilson Baker, M.A., D.Sc., F.R.S.; C. E. H. Bawn, B.Sc., Ph.D.; J. Bell, D.Sc., Ph.D., F.R.I.C.; R. P. Bell, M.A., B.Sc., F.R.S.; L. Hunter, Ph.D., D.Sc., F.R.I.C.; F. E. King, M.A., D.Phil., D.Sc.; L. N. Owen, Ph.D., D.Sc., F.R.I.C.; E. G. V. Percival, Ph.D., D.Sc., F.R.I.C.; H. M. Powell, M.A., B.Sc.; J. D. Rose, MA., B.Sc.; H. N. Rydon, D.Sc., D.Phil., F.R.I.C.; C. W. Shoppee, D.Sc., D.Phil., F.R.I.C.; J. W. Smith, Ph.D., D.Sc., F.R.I.C.; R. Spence, Ph.D., D.Sc., F.R.I.C.; T. S. Stevens, B.Sc., D.Phil., A.R.I.C.; A. R. J. P. Ubbelohde, M.A., D.Sc., F.R.S.; A. I. Vogel, D.Sc., D.I.C., F.R.I.C.; J. Walker, Ph.D., D.Phil., D.Sc.; W. A. Waters, M.A., Sc.D., F.R.I.C.

Mr. Stanley Robson, president of the Society of Chemical Industry left, and Mrs. Robson, talking with Sir Wallace Akers, C.B.E., treasurer of the Chemical Society

Ex-Officio Members of Council: H. E. Cox, D.Sc., Ph.D., F.R.I.C. (Chairman of the Joint Library Committee); A. Findlay, C.B.E., D.Sc., LL.D., F.R.I.C. (Chairman of the Chemical Council); L. H. Lampitt, D.Sc., F.R.I.C. (Chairman of the Bureau of Abstracts).

General Secretary: J. R. Ruck Keene, M.B.E., T.D., B.A.

A 'Typical Chemist'

At the anniversary dinner the toast 'The Chemical Society' was proposed by Professor E. D. Adrian, O.M., president of the Royal Society. Professor Adrian, who has been Professor of Physiology at Cambridge since 1937, said that chemistry as a science needed no justification. Any chemist who had survived his apprenticeship was easily recognisable. He was usually of spare build and of medium height and frequently was a collector of wild flowers, birds or other inexpensive objects when young, and of Ming vases and the like once he had been recognised by industry.

The ordinary diet of the chemist was too bulky. He had attended an international conference at which stacks of published material had practically obliterated those attending. Although the publications of the Chemical Society were much too important to stand much pruning there was a danger that the brains of members might become congested. Burlington House was a most imposing place but there was little room there. However, he was sure the Chemical Society would have some regrets if or when it left Burlington House. Members would miss the Royal Academy and they would miss Piccadilly.

The chemists were doing wonderful work. When it came to chemotherapy and the development of the antibiotics they had something really worth while, and the work was just beginning. The whole pattern of living was just beginning to come under complete control. It was not the results which impressed the onlooker but the grand scale on which things were being carried out. The Society, by developing the science, had made possible the development of the great industries without which no country could progress.

In conclusion Professor Adrian said that the Society's president, Professor Rideal, had done great service to the Society wherever he had been.

The Royal Society

In his response, Professor Rideal, who is professor of physical chemistry, King's College, London, and an expert on colloid chemistry, catalysis and surface chemistry, said that under a long succession of presidents, the Royal Society had always kept a very benevolent eye on chemistry and the Chemical Society should and did pay tribute to Sir Robert Robinson. He thought

Professor E. K. Rideal, M.B.E., F.R.S., president of the Chemical Society, and Mrs. Rideal receiving their guests

they could assure the president of the Royal Society that they would be pleased to be under the aegis of that august body.

There were several misconceptions about the Chemical Society. It did not consist only of long-haired professors dealing only with abstract papers. It also contained the great chemists in the large industrial firms who were supposed to be raising the standard of living and increasing exports. It was true, however, that while they could now get aureomycin in capsule form they could no longer get a pork sausage. Then they had members from the governmental scientific departments which were so ably looked after by Sir Ben Lockspeiser whom they were glad to have with them that night. The fourth category for members was those who came from the great nationalised industries.

It was all to the good that members of each of these categories should meet together for it was the duty of the Society to advance the study of chemistry. They tried to do this by promoting research, spreading information and by holding centralised and localised meetings of chemists. They were a very small society compared with the American Society of Chemistry which had a membership of 66,000, but last year they had published some 870 papers. Of these 15.7 per cent were contributed from overseas, 11.6 per cent by industrial organisations and 4.3 per cent by Government institutions. A study of the sources from which material came over a period of years showed that the number coming from industrial organisations was increasing.

Sir Ben Lockspeiser, F.R.S., secretary, the Department of Scientific and Industrial Research, with Lady Lockspeiser

Dr. J. R. Nicholls, C.B.E., president of the Society of Public Analysts and Other Analytical Chemists, and Deputy Government Chemist, with Mrs. Nicholls

The Society's dues, with present taxation, were a burden to younger members and he thought that there ought to be some income tax concession made. Twenty per cent of members lived and worked overseas and this proportion was increasing.

Their sister chemical societies in the Commonwealth were beginning to grow and he felt that they should know more about them. It was possible that they could help

one another. He felt that during the next decade or so they should be able to meet freely.

In conclusion Professor Rideal welcomed the scientific liaison officers from the various commonwealth countries and thanked fellows of the Society for the great honour they had done him in making him president.

Sir Wallace Akers, Kt., C.B.E., who is a former Director of Atomic Energy Research and a director of I.C.I., proposed 'The Guests,' making special reference to Sir Gerald Kelly, president of the Royal Academy, who responded.

Amongst those attending the dinner were the following:—D. H. R. Barton, Corday-Morgan Medallist; L. F. Bates, F.R.S., President, The Physical Society; F. M. Birks, C.B.E., President, The Institution of Gas Engineers; J. W. Cook, F.R.S., President, The Royal Institute of Chemistry; C. J. T. Cronshaw, Prime Warden, The Worshipful Company of Dyers; J. E. Cummins, Chief Scientific Iiaison Officer, Commonwealth of Australia; J. P. de Wit, Scientific Liaison Officer, Union of South Africa; H. Dingle, President, The Royal Astronomical Society; B. C. Dodds, M.V.O., F.R.S., Chairman of Committee, The Biochemical Society; S. F. Dorey, C.B.E., Chairman, The Chemical Council; Sir Archibald Gill, President, The Institution of Civil Engineers; W. H. Glanville, C.B.E., President, The Institution of Civil Engineers; Sir Charles Goodeve, O.B.E., F.R.S., President, The Faraday Society; Sir Harold Hartley, F.R.S., Chairman of the Council, The British Association for the Advancement of Science; H. P. Himsworth, Secretary, The Medical Research Council; C. K. Ingold, F.R.S., Longstaff Medallist;

Mr. G. A. N. Hirst, M.P., right, and Mr. J. W. Ramsay

R. L. Kenyon, European Representative, The American Chemical Society; S. Krishna, Scientific Adviser to the High Commissioner for India; L. H. Lampitt, Chairman, The Bureau of Abstracts; Sir Ben Lockspeiser, F.R.S., Secretary, The Department of Scientific and Industrial Research; H. C. Longuet-Higgins, Harrison Memorial Prizeman; J. G. Malloch, Scientific Liaison Officer, Dominion of Canada; A. J. Murphy, President, The Institute of Metals; D. M. Newitt, F.R.S., President, The Institution of Chemical Engineers; J. R. Nicholls, C.B.E., President, The Society of Public Analysts and Other Analytical Chemists; Major R. P. Porter, President, The British Association of Chemists; Stanley Robson, President, The Society of Chemical Industry.

Professor J. W. Cook, F.R.S., president of the Royal Institute of Chemistry, with Sir Charles Goodeve, O.B.E., F.R.S., president of the Faraday Society, and Lady Goodeve

Overcoming The Sulphur Shortage

Methods Investigated by the DSIR

RESEARCH into methods of overcoming the sulphur shortage formed an important part of the investigations carried out under the Department of Scientific and Industrial Research, of which the 35th annual report for the year 1949-1950 (HMSO, 4s. 6d.) was published last week.

The study of sulphate-reducing bacteria at the Chemical Research Laboratory has led to important practical developments. Initially, attention was directed almost exclusively to their activities in the widespread and virulent corrosion of ferrous pipes in waterlogged clay soils. Laboratory and large scale experiments enabled the staff to give advice on this type of corrosion.

Latterly, routes of large-scale pipe laying schemes have been inspected, soil samples tested and the appropriate protective measures advised. The application of adequate protection to pipes laid in aggressive soils—which the Chemical Research Laboratory has been foremost in promoting—will undoubtedly save millions of pounds and much valuable iron and steel.

Refuse disposal is also intimately connected with sulphate-reducing bacteria. Present methods are expensive and are becoming increasingly difficult. There are thousands of derelict acres of wet gravel pits which could be restored to use if filled with refuse; but indiscriminate tipping causes intolerable nuisance due to the action of sulphate-reducers in producing hydrogen sulphide. The Chemical Research Laboratory in collaboration with local authorities has devised a scheme for dealing with the problem. Large scale experiments have shown the feasibility of the scheme, which is shortly to be put into operation on a larger scale.

Micro-Biological Production

More recently, the gravity of the sulphur supply situation has led to a consideration of the possibility of its micro-biological production. Great Britain is dependent for sulphur on foreign sources, mostly outside the sterling area, at an annual cost of over £3 million.

There is no doubt that sulphur can be produced by appropriate bacteria; this has been shown by laboratory experiments at the Chemical Research Laboratory, and its large-scale occurrence in nature was investigated recently during a visit to some sulphur-producing lakes in Cyrenaica. The chief obstacle to a successful industrial exploitation of this process is the low specific rate of production of sulphates. Research is proceeding with a view to quickening up the process. There are abundant indigenous raw materials for such a process which, if successful, would make a substantial contribution to the supplies of sulphur.

Solvent Extraction of Oxides

Work by the Gas Research Board on the solvent extraction of spent oxides has shown that from oxide from a purification stream (with adequate oil washing of the gas and with tar extractors before the purifiers) sulphur can be obtained of sufficiently high purity (more than 99 per cent) for the manufacture of sulphuric acid by the contact process. A flow method of extraction of hydrogen sulphide coupled with recovery of pure sulphur and recirculation of activated oxide is also being studied.

A major problem of the steel industry is the need for economy in the use of sulphuric acid for pickling, particularly important in the making of continuous strip. The 'spent' pickling liquor is a solution of ferrous sulphate of copperas, formed from the sulphuric acid used for descaling steel. A method of regenerating fresh sulphuric acid from the copperas has been developed at the South Wales laboratory of the British Iron and Steel Research Association and plans for semi-scale operation at a steelworks in South Wales are well advanced.

The copperas, mixed with coke, will be flash roasted and the oxides of sulphur produced will be absorbed directly in water and oxidised catalytically, giving a sulphuric acid of strength suitable for pickling with further dilution. An economic appraisal of the process operating on a large scale indicates that it should result in substantial savings to the industry.

Study of methods for the removal of sulphur compounds from flue gases is being continued by the Fuel Research Station, special consideration being given to recovering the sulphur in useful form.

Work on a pilot plant installed to scrub 1,000 cu. ft. of flue gas per hour from a Lancashire boiler with concentrated gas liquor (15 per cent crude ammonia) has reached a satisfactory conclusion in that conditions have been found under which the chemical control of the plant becomes practicable. A larger plant, to scrub 25,000 cu. ft. of flue gas per hour has therefore been designed in order to obtain data for continuous running on such a scale that the information will be valuable in the design of a full-scale unit. This plant is now being constructed.

Investigations Continue

Investigations of the economics of the various processes available for the production of sulphur or sulphuric acid from indigenous sources have been continued in connection with a Working Group set up by the Board of Trade. In addition, in collaboration with the National Sulphuric Acid Association, a report on this subject has been presented to the Chemical Products Committee of the Organisation for European Economic Co-operation.

Other work by the Fuel Research station included the continuation of laboratory-scale and semi-technical scale investigations on methods of producing water-gas, synthesis gas, and producer gas from small-sized, high-ash fuels has been continued.

A novel process for the production of water-gas from small-sized fuels has been devised, and construction of a pilot plant is in hand. This process is based on the high rates of heat transfer which can be obtained in fluidised beds of solid particles, and uses a fluidised bed of incandescent fuel from which water-gas is generated with steam at about 900°C. The bed is contained in a heat-resisting steel cylinder, externally heated by an air-blown fluidised bed of incandescent fuel at 950-1,000°C. This procedure might enable a wide range of relatively cheap fuels to be used instead of high-grade coke for the generation of water-gas.

The possibility of using low-grade fuels, especially coke breeze and washery fines, in the manufacture of producer gas is being investigated.

Study of the Fischer-Tropsch process for producing liquid fuels and chemical products from coal has been extended to include the erection of pilot plants of 30 to 50 gallons per day capacity.

Objects of the work are to extend the knowledge in this country of the process, to study the products in relation to national requirements, and to provide the chemical-engineering knowledge necessary to enable full-scale plants to be constructed when and where economic conditions are favourable.

As a result of research on laboratory and somewhat larger scales, a suitable iron synthesis catalyst and conditions for its operation have been selected and sufficient experience of the fluidised-catalyst technique has been gained to permit the design of a reaction vessel for the pilot plant. This reaction vessel and its ancillary equipment is under construction and should be in operation during 1951.

Considerable progress has been made on a laboratory scale with the study of an alternative process in which finely powdered catalyst is suspended in high-boiling oil. This technique avoids certain disadvantages of the fluidised-catalyst system such as lack of flexibility in product composition and excessive formation of free carbon and methane. A pilot-scale reaction vessel for this process is being designed.

The process development work is being accompanied by work of a more fundamental character, which is concerned with the rôle of oxygen-containing compounds in the synthesis reaction mechanism, the factors affecting carbon formation on iron catalysts, and the chemical composition and physical properties of iron catalysts and their activity and effect on product distribution.

Jute Research Extended

Following the expansion of its premises in Dundee there was considerable extension of the work of the British Jute Trade Research Association.

In applied research the chemical section has continued its work on treatments designed to resist the attack of specific chemicals on jute. Large-scale usage trials with one particular type of jute package have confirmed the satisfactory performance under acid conditions of a protective treatment originated in the laboratories.

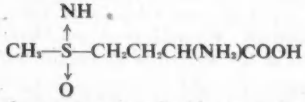
The analysis of the chemical constituents of lignified bast fibres and the investigation of the chemical changes resulting from the treatment of jute with acids and alkalis has continued.

Other investigations designed to elucidate the chemical constitution of the jute fibre include the estimation of the number of carboxyl groups present from the methylene

blue absorption values, and of the aldehydic groups by oxidation with iodine. Work has also been commenced on the identification of the sugars obtained by the acid hydrolysis of the hemicelluloses of jute.

Staling of bread investigated by the British Baking Industries Research Association raised fundamental research problems of some magnitude. Most hopeful possibilities, so far, would appear to be the inclusion of glyceryl mono- and di-stearates.

In further work on flour improvers by the Research Association of British Flour Millers, the chemistry of the toxic factor formed by the action of Agene (nitrogen trichloride) on proteins has been elucidated. Its constitution and structure has been shown to be



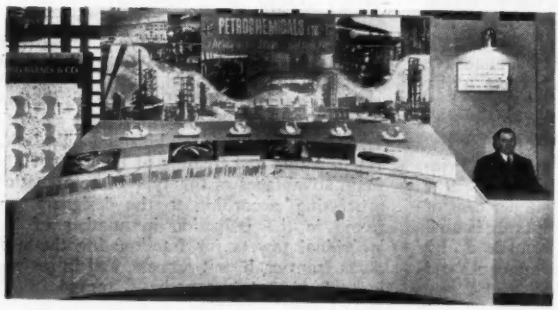
and compounds of this type have been designated 'sulphoximines.' *l*-Methionine sulphoximine has been synthesised by the action of hydrazoic acid on *l*-methionine sulphoxide under the conditions of the Schmidt reaction and the product proved to be identical with the toxic factor. Several other members of the sulphoximine series have been made by this method and dimethyl sulphoximine has been synthesised by the alternative route through the sulphilimine.

In this work, chromatography has been an indispensable tool, but the customary use of only partially watermiscible solvents was found a serious disadvantage. A method was developed for using aqueous solvent mixtures and R_F values were correlated with water content of the solvent mixture and identity of amino-acid and of the alcohol used as developing solvent. It was shown that, with volatile solvents, a modification of the conventional form of apparatus is required.

Carbon black is mostly made from imported petroleum or its by-products, although new types are now being made both in the U.S.A. and the United Kingdom by more economic methods than hitherto. It is the most effective material known for 'reinforcing' rubber, that is improving its strength and resistance to wear and tear.

Efforts are being made by the Research Association of British Rubber Manufacturers to make use of common materials occurring in the U.K., such as calcium carbonate, as an alternative.

Nearly 1,000 researches completed, or being studied, are mentioned in the report.



Two of the stands at the recent technical exhibition held at the Borough Polytechnic, London by the Oil and Colour Chemists Association. Above: The display by the Paint Research Station which showed the theoretical method of study of paint pigments. Left: Petrochemicals show of aromatic raw materials.

(see page 461 of last week's issue)

Wood Preservation

Its Importance in America

AN EXTENSIVE study on the wood preservers' contribution to the conservation of America's wood supplies, by Mr. Grant B. Shipley, gives an interesting sidelight on this important branch of the chemical preservatives field. The American wood preservation industry, points out Mr. Shipley, saves an enormous amount of wood each year. Treated wood lasts roughly five times as long as untreated wood, and from statistics available as far back as 1909, the average amount of wood saved per year in America since then has been 10,800,000,000 board feet. As an example of what this really means to a country, this fraction represents exactly one-third of the country's annual consumption of timber, or the yield from 5,000 square miles of commercial forest land. Alternatively, it would build well over a million houses. This saving is, of course, quite apart from the financial gain involved.

The largest users of treated wood in the U.S. have been the railroads, although this market is now saturated. Next come the telephone and telegraph companies and public utilities, and lastly the largely untapped market of the building and construction industry. It is in this field that the preservation industry hopes to increase its markets from the present low figure of 1.3 per cent of lumber consumed to 5 per cent.

The economic picture of the industry has never been a particularly affluent one. The margin of gross profit is small, and only the efficient, careful operators have been able to earn a fair return on their investment. Wood preservation calls for large stocks of ready-treated lumber and preservatives, as well as plant machinery and equipment, and, in some cases timber land necessary to ensure a constant supply of wood. Forty years ago, when timber and labour were cheap, railroads considered 15 years' life adequate for treated cross-ties. Now they expect a life of 40 years.

Creosote Principle Preservative

The preservatives used are several. Principle one, of course, is creosote and its near derivatives, which account for 86 per cent of the total treated wood. Zinc chloride is used for 12 per cent, and the rest is made up by zinc meta-arsenite, pentachlorophenol and others.

The general picture is summed up by Mr. Shipley (who is a Pittsburgh consulting engineer), when he says that the saw-timber in the American forest-lands is being depleted faster than it is being replaced. It takes 50 to 150 years to grow saw logs, and the only solution, he says, is to grow more timber and treat that used at present with recognised preservatives.

Labour Relations Talk

THE Society of Chemical Industry of Canada is holding its third and final meeting of the season in Montreal on 9 April, when the speaker will be Dr. W. H. Garrett, O.B.E., of Monsanto Chemicals, Ltd., of Great Britain. He will speak on 'Labour relations in the British chemical industry.'

Dr. Garrett is going to Canada for the express purpose of addressing the meeting. He will speak with authority on his subject as he has had many years of experience in this field, having been a member of the Executive Board of the Association of Chemical and Allied Employees of Great Britain for 21 years and its chairman since 1949. He is also a member of the National Arbitration Tribunal. Because of this long period of service Dr. Garrett is familiar with the possible differences in the attitudes of the past and present parties in power in Great Britain.

British-American Refinery

A COMBINATION plant, claimed to be the most advanced of its type in the world, is at present being constructed for the British American Oil Co., Ltd., at Alberta, Canada, by the Canadian Kellogg Co., Ltd. The refinery is a complete combination plant operating off one central control room. Processing equipment includes crude distillation, delayed coking, thermal and fluid catalytic cracking, petroleum stabilising, light ends fractionating and treating of light oils. The main advantages of this type of combination processing, according to the designers, are found in the reduction in number of the individual towers for fractionating the products from each unit process, and in savings in tankage for intermediate storage.

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Work Done in the Analytical Field

The first instance dealt with was that of cobalt and animal health. The history was told of severe losses of sheep and cattle some years ago, from wasting diseases of an unknown origin, in certain areas of New Zealand and Australia; of how it was generally regarded as some form of anaemia and treated accordingly but without success; of how one form of treatment, however, namely, drenches of a particular type of soil, was found to be effective as a cure; and finally of how analysis of these drenches and of the soil supplied the answer to the problem—deficiency of the trace element, cobalt.

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The third instance concerned the metallic contamination of foodstuffs. Here it was postulated that productivity must be interpreted not only in terms of quantity or volume but also in terms of nutritional value. A foodstuff containing a trace of a metallic element which may be potentially toxic, and therefore capable of producing an obscure form of chronic disease difficult to diagnose, obviously tends to lose its productivity value. Examination of the medical data of the effect in human metabolism of elements like arsenic or lead shows that little is known, or in fact can be known, about such effect on human beings as the result of daily ingestion of minute traces. The only apparent answer to this problem would appear to be a systematic quantitative analysis of all the common foodstuffs for traces of these elements and a survey of medical records of the population for the purpose of ascertaining whether there is any evidence of harm attributable to such causes. The above groups were dealt with at length.

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PERSONAL

The council of the University College of North Wales has announced the appointment of DR. WILLIAM CHARLES EVANS (special lecturer in biochemistry and head of the agricultural biochemistry laboratories in the Department of Agriculture, Aberystwyth) as professor of agricultural chemistry at Bangor in succession to the late Professor G. W. Robinson. Dr. Evans is a native of Bethel, Caernarvonshire, and a graduate of the University College, North Wales. He also studied at Manchester. His first appointment was that of lecturer in biochemistry at Leeds University, and during the war he acted as director of the emergency blood transfusion service at Leeds, and as chemical microbiologist at St. Mary's Hospital Medical School, London.

MR. J. C. SWALLOW has been appointed joint managing director of the Plastics Division, Imperial Chemical Industries, Ltd. Research director of the Division since 1942, he was, before that, research manager of the Alkali Division of I.C.I., where he was in charge of the research work that led to the discovery and manufacture of polythene. In January this year he delivered a series of Contor Lectures at the Royal Society of Arts on 'The Plastics Industry.' MR. E. G. WILLIAMS has been appointed to succeed Mr. Swallow as research director. Mr. Williams joined the organisation in 1934 and has been with Plastics Division since 1943, and was previously deputy manager of the Division's Research Department.

DR. EDGAR C. BRITTON, director of the organic research laboratory of the Dow Chemical Company, Midland, Michigan, has been chosen president-elect of the American Chemical Society. He will take office in 1952. The doctor has had more than 260 patents for new synthetic organic chemicals issued in his name in the past 30 years. His contributions include improved methods of producing carbolic and acetic acids, as well as the development of compounds for use as insecticides, fungicides, herbicides, pharmaceuticals and catalysts for the production of butadiene from butylene.

MR. C. CLARK, who was recently elected chairman of the West Riding section of the Society of Dyers and Colourists in Bradford, has for many years been a prominent worker for the society, of which he has been a member for over 30 years and has been particularly identified with the publications committee. He is a Fellow of the Textile Institute and a chemist and librarian at the Bradford Dyers' Association, Ltd.

* * *

The following Institute of Physics elections were made on 15 March:—

Fellows: S. L. ANDERSON (Leeds), N. CLARKE (Leigh-on-Sea, Essex), M. M. DAS (Southport, Lancs.), H. D. L. PUGH (Drayton, Middlesex), R. W. SILLARS (Hale, Cheshire), E. H. S. VAN SOMEREN (Broxbourne, Herts), J. R. S. WARING (Manchester).

Associates: M. BARBANEL (Huntingdon), I. W. BISSETT (Australia), N. BROWN (Reading, Berks.), G. C. CATO (South Africa), D. E. C. CORBRIDGE (Stretford, Lancs.), J. A. F. CORNICK (Nantyglo, Mon.), R. D. DE SILVA (Ceylon), W. K. DYER (Cheltenham, Glos.), K. E. A. EFFAT (Birmingham), R. D. MALCOLMSON (Australia), M. D. MCNICHOLL (Australia), R. N. THOMSON (Birmingham), K. R. VALE (Australia), and J. F. YOUD (London).

Fertiliser Society Meeting

The next general meeting of The Fertiliser Society will, at the kind invitation of Dr. Pratt, the Director, be held at the Chemical Research Laboratory of the Department of Scientific and Industrial Research, Coleshill Road, Teddington, on Thursday, 12 April. The following is the programme for the meeting: 11 a.m., Paper by Dr. F. M. Reynolds, B.Sc., on 'Research on Phosphate Fertilisers at the Chemical Research Laboratory of the D.S.I.R.,' followed by a discussion—in the Lecture Theatre of the National Physical Laboratory adjoining. 1 p.m., Lunch at the Greyhound Hotel, Hampton Court. 2.45 p.m., Tour of the Chemical Research Laboratories.

Next Weeks' Events

MONDAY 2 APRIL

Oil and Colour Chemists' Association

Hull: Royal Station Hotel, 7 p.m. K. G. Hargreaves: 'Organic Pigment Analysis.'

Society of Chemical Industry

London: Royal College of Science, Huxley Building, Exhibition Road, South Kensington, S.W.7, 2.15 p.m. Two-day symposium on Applications of Colloid Science to Industry. (Jointly with RIC.)

TUESDAY 3 APRIL

Hull Chemical and Engineering Society

Hull: Church Institute, 7.30 p.m. Annual general meeting.

The Institute of Fuel

London: Institution of Mechanical Engineers, Storey's Gate, St. James's Park, S.W.1, 5.30 p.m. Papers on Underground Gasification presented by C. A. Masterman, Dr. E. T. Wilkins and J. L. Elder.

WEDNESDAY 4 APRIL

The Chemical Society

Dublin: Chemical Laboratory, Trinity College, 7.45 p.m. Professor J. Read: 'Humour and Humanism in Chemistry.' (Jointly with RIC and SCI.)

Society of Public Analysts

London: Burlington House, Piccadilly, W.1, 7 p.m. Three papers will be presented.

THURSDAY 5 APRIL

The Chemical Society

Belfast: Department of Agriculture, 7.30 p.m. R. F. Innes: '48 Years in the Profession of Chemistry.'

The Institute of Metals

Birmingham: James Watt Memorial Institute, Great Charles Street, 6.30 p.m. Annual general meeting.

London: 4 Grosvenor Gardens, S.W.1, 7 p.m. Annual general meeting.

Leeds Metallurgical Society

Leeds: The University, 7 p.m. Lieut.-Col. H. Dearns: 'Training for Industrial Metallurgists.'

Liverpool Metallurgical Society

Liverpool: Electricity Service Centre, Whitechapel, 7 p.m. Annual general meeting.

Royal Institute of Chemistry

Luton: King's Fare Restaurant, King Street, 7.30 p.m. A. C. Monkhouse: 'Recent Trends in Fuel Research.' (Jointly with SCI.)

Institution of Chemical Engineers

Birmingham: The University, Edgbaston, 11 a.m. Symposium on Packed Columns.

FRIDAY 6 APRIL

The Chemical Society

Cork: University College, 7.45 p.m. Professor J. Read: 'Humour and Humanism in Chemistry.' (Jointly with RIC and SCI.)

Institution of Chemical Engineers

Manchester: Reynolds Hall, College of Technology, 6.30 p.m. R. O. Gibson: 'The Recovery of Bromine from Sea Water.'

Infra-Red Technique

AT a meeting of the Physical Methods Group of the Society of Public Analysts at Leeds on 9 March, a paper, 'The scope of infra-red analysis,' was read by Dr. N. Sheppard.

A short account was given by Dr. Sheppard of the main factors affecting the position and intensity of infra-red absorption bands and some generalisation was deduced as to the types of molecules or groupings that could most easily be detected or accurately estimated by infra-red methods.

Another paper, 'Infra-red spectrometry in the petroleum industry,' was read by Dr. H. Powell.

Infra-red spectrometry, said Dr. Powell, was extremely useful in the field of hydrocarbon gas analysis, as it made possible the determination of the individual paraffins and olefins in a particular fraction so long as the number of components present was not too large. It might also be used for the determination of carbon monoxide, carbon dioxide and sulphur dioxide in flue gases, as well as other purposes.

OVERSEAS

Scientific Instruments Display in Paris

An exhibition of British scientific research instruments, in which university and government laboratories as well as private industrial firms will take part, will be held at the Sorbonne, Paris, during 11-12 and 15-17 May. This will be independent of the 48th annual exhibition of scientific instruments and apparatus organised by the French Physical Society which will also take place at the Sorbonne on the same dates and times.

Sulphur Production in the U.S.A.

Production of sulphur in the U.S.A. in November, 1950, reached 424,269 long tons, according to the U.S. Bureau of Mines. This was slightly less than the total for the previous month, but was greater than November, 1949. During the first 11 months of 1950 output was 4,756,894 tons compared with 4,352,359 tons in 1949. Stocks at the end of November, 1950, were reduced to 2,762,528 tons as against 3,114,865 at the end of the same month of the previous year.

U.S. Aluminium Production

Domestic production of primary aluminium in December, 1950, totalled 65,897 short tons according to the Bureau of Mines, U.S. Department of the Interior. December output completed a record year for 1950 of 718,627 tons, the largest total since 1944. Stocks reported at the end of December were 16,636 tons, which closed the year with the highest total since February.

American Chemical Society Jubilee

The American Chemical Society is celebrating its diamond jubilee in 1951, and marking it by holding a two-week chemical conclave in New York and Washington in September to bring the year's programme to a climax. Other activities in the programme will include community and campus meetings, exhibits, etc., covering over 100 localities throughout the United States. Delegates from more than 30 countries will attend the conclave, which will be opened by the 75th meeting of the American Chemical Society from 3-7 September in New York. After this the 12th International Conference of Pure and Applied Chemistry, and the 16th Conference of the International Union of Pure and Applied Chemistry will take place in New York and Washington.

Manganese Control in S.A.

It was announced in Parliament by Mr. Louw, South African Minister of Economic Affairs, on 14 March, that exports of manganese ore and other materials would be prohibited except under permit.

Life of Outdoor Plastics Prolonged

Chemical guards providing protection against the damaging ultra-violet solar rays are being recommended in America to reduce the brittleness and crumbling produced by sunlight, rain, and heat on outdoor plastics of all kinds. The action of the ultra-violet light is to break down the polymerised chains of which the plastic is composed, and the safeguards—phenyl benzoate derivatives—absorb this light and convert it into heat without damage to themselves or the plastic. Experiments with six different compounds in Arizona have been successful, and they should in the future greatly benefit the automobile, outdoor advertising, and irrigation industries and many others.

Radioactive Adrenaline for Research

Synthetic radioactive adrenaline has been produced in America and is now being employed to study the profound effects the drug produces in the body, Dr. Richard W. Schayer, of the Rheumatic Fever Research Institute at the North Western University Medical School at Evanston, Illinois, reports. It is one of the first radioactive hormones to be produced synthetically.

Adrenaline increases blood pressure, stimulates the heart, and is involved in the transmission of nerve impulses in a part of the involuntary nervous system. Dr. Schayer points out, so that a thorough knowledge of the drug's action in the body is of obvious importance. Many investigations have been undertaken in the past, using non-radioactive adrenaline, but much greater progress is to be expected now that the tagged compound is available. Already evidence indicating that adrenaline is converted into at least five substances in the body has been obtained in animal experiments with the radioactive drug, which contains carbon-14, Dr. Schayer reports, and efforts to identify the substances found are now in progress.

Law & Company News

Commercial Intelligence

The following are taken from the printed reports, but we cannot be responsible for errors that may occur.

Mortgages and Charges

(Note.—The Companies Consolidation Act of 1908 provides that every Mortgage or Charge, as described herein, shall be registered within 21 days after its creation, otherwise it shall be void against the liquidator and any creditor. The Act also provides that every company shall, in making its Annual Summary, specify the total amount of debt due from the company in respect of all Mortgages or Charges. The following Mortgages or Charges have been so registered. In each case the total debt, as specified in the last available Annual Summary, is also given—marked with an *—followed by the date of the Summary, but such total may have been reduced.)

H. BOWNESS, LTD., Luton, chemists. (M., 24/3/51). 12 January, £2,000 debentures, to D. G. Hanton, Luton; general charge.

JOHN PEAK & CO., LTD., Wigan, chemical manufacturers. (M., 31/3/51). 15 January, first debentures, to Westminster Bank, Ltd., securing all moneys due or to become due to the bank; charged on leasehold premises at Soho Street, and freehold 47 and 49 Soho Street, Pemberton, Wigan, and a general charge. *Nil. 6 September, 1950.

ELFYN REES, LTD., Pontypool, chemists. (M., 24/3/51). 6 January, £1,600 charge, to Monmouthshire and South Wales Building Society; charged on 2 Golf Road, Pontypool Road (Mon.). *£3,000. 11 September, 1950.

Satisfactions

ENGLISH STEEL CORPORATION, LTD., Sheffield. (M.S., 24/3/51). Satisfaction, 11 January, of Trust Deed and supplemental deeds registered 7 October, 1932, 16 January, 1935, and 1 December, 1936, to the extent of £29,767.

FISONS, LTD., Ipswich, fertiliser manufacturers. (M.S., 31/3/51). Satisfaction, 13 January, of amount outstanding 1 July, 1908.

MANNAH, LTD., Skegness, chemists. M.S., 31/3/51). Satisfaction, 12 January, of mortgage registered 5 October, 1949.

Company News

Ilford, Ltd.

The directors of Ilford, Ltd., have declared that the dividend on the 6 per cent cumulative preference shares for the half-year ending 30 April, 1951, at the rate of 6 per cent per annum, less income tax at 9s. in the £, be paid on 1 May, 1951.

Monsanto Chemicals, Ltd.

The extensive programme of expansion which has been in progress for the last few years has no doubt been largely responsible for the big rise in profits of Monsanto Chemicals, Ltd., for the year ended 31 December, 1950. Group net profit was £607,536 (£318,085). Final ordinary dividend recommended is 40 per cent (30 per cent), making a total of 55 per cent less tax, compared with 45 per cent less tax in 1949. A scrip bonus is announced on the basis of two ordinary shares for every 5s. ordinary stock unit held by capitalisation of share premium account. It is also proposed to capitalise 1,500,000 cumulative redeemable second preference shares of £1 each for cash, subject to the terms of the issue being agreed with the Capital Issues Committee.

Negretti and Zambra, Ltd.

The fourth annual general meeting of Negretti and Zambra was held in London on 20 March. Profit was £163,114 for 1950, compared with £159,648 for the previous year. Final dividend of 15 per cent on the ordinary shares was recommended, and assuming progress to be maintained an interim dividend of 5 per cent, instead of 4 per cent as previously, is anticipated in September.

Hilger and Watts, Ltd.

Research and development had been intensified during the year, stated Mr. G. A. Whippke, chairman and managing director of Hilger and Watts, Ltd., at its third annual general meeting held in London on 19 March. Facilities at Camden Town had been enlarged to ensure the evolution of new instruments for research and industry, and for the revision of designs to ensure greater ease in manufacture and assembly. To comply with the modern trend an electronic section had been constituted in the research department. Trading had not been easy, but, nevertheless, demand had been satisfactory and a noteworthy feature was the increase in orders from the U.S.A. which was now the third largest overseas customer. Net profit was £35,753, a reduction of £4,475 on the previous year. A first and final dividend of 7½ per cent on the ordinary shares, less income tax (same), was recommended.

British Chemical Prices

LONDON.—Despite the influence of the Easter holiday, interest in the industrial chemicals market has remained fairly active with chief attention centred on the problems created by the scarcity of sulphur. Routine deliveries against contracts have been on a good scale and the seasonal demand for fertilisers has continued without interrupton. Tartaric and citric acids are in strong request and there is a persistent demand for sodium chlorate, and much the same could be reported for most of the sodium compounds. Nothing of fresh importance falls to be reported on the coal tar products market and prices remain firm.

MANCHESTER.—Trading conditions have been quieter on the Manchester chemical market during the past week, but this is attributed entirely to the seasonal influence of the Easter holiday break. Deliveries were steadily resumed against contracts when the using establishments restarted work and no slackening of the demand for all the leading bread-and-butter lines is anticipated. The scarcity of sulphuric acid, sulphur and certain other heavy chemicals continues to have a harassing effect on the textile and other consuming outlets. An active movement of most of the tar products has also been resumed.

GLASGOW.—There has been considerable activity in the Scottish heavy chemical market during the past week although supplies of many chemicals and raw materials are still restricted. The export market has also been fairly active.

General Chemicals

Acetic Acid.—Per ton : 80% technical, 1 ton, £69 ; 80% pure, 1 ton, £74 ; commercial glacial 1 ton, £82 ; delivered buyers' premises in returnable barrels ; in glass carboys, £7 ; demijohns, £11 extra.

Acetic Anhydride.—Ton lots d/d, £118 per ton.

Acetone.—Small lots : 5 gal. drums, £105 per ton ; 10 gal. drums, £100 per ton. In 40/50 gal. drums less than 1 ton, £85 per ton ; 1 to 9 tons, £84 per ton ; 10 to 50 tons, £83 per ton ; 50 tons and over, £82 per ton.

Alcohol, Industrial Absolute.—50,000 gal. lots. d/d, 2s. 5d. per proof gallon ; 5000 gal. lots, d/d, 2s. 6½d. per proof gal.

Alcohol, Diacetone.—Small lots : 5 gal. drums, £133 per ton ; 10 gal. drums, £128 per ton. In 40/45 gal. drums : less than 1 ton, £113 per ton ; 1 to 9 tons, £112 per ton ; 10 to 50 tons, £111 per ton ; 50 to 100 tons, £110 per ton ; 100 tons and over, £109 per ton.

Alum.—Loose lump, £17 per ton, f.o.r. MANCHESTER : Ground, £17 10s.

Aluminium Sulphate.—Ex works, £11 10s. per ton d/d. MANCHESTER : £11 10s.

Ammonia, Anhydrous.—1s. 9d. to 2s. 3d. per lb.

Ammonium Bicarbonate.—2 cwt. non-returnable drums ; 1 ton lots £47 per ton.

Ammonium Chloride. — Grey galvanising, £27 10s. per ton, in casks, ex wharf. Fine white 98%, £21 10s. to £22 10s. per ton. See also Salammoniac.

Ammonium Nitrate.—D/d, £18 to £20 per ton.

Ammonium Persulphate. — MANCHESTER : £5 15s. per cwt. d/d.

Ammonium Phosphate.—Mono- and di-, ton lots, d/d, £88 and £86 10s. per ton.

Antimony Sulphide.—Golden, d/d in 5 cwt. lots as to grade, etc., 1s. 9½d. to 2s. 4¾d. per lb. Crimson, 2s. 6½d., to 3s. 3½d. per lb.

Arsenic.—Per ton, £44 5s. to £47 5s., ex store.

Barium Carbonate.—Precip., d/d ; 2-ton lots, £30 per ton, bag packing, ex works.

Barium Chloride.—£38 to £38 10s. per ton.

Barium Sulphate (Dry Blanc Fixe).—Precip., 4-ton lots, £33 5s. per ton d/d ; 2-ton lots, £33 10s. per ton.

Bleaching Powder.—£19 10s. per ton in casks (1 ton lots).

Borax.—Per ton for ton lots, in free 140 lb. bags, carriage paid: Anhydrous, £54; in 1-cwt. bags, commercial, granular, £34 10s.; crystal, £37; powder, £38, extra fine powder, £39; B.P., granular, £44; crystal, £46; powder, £48-£48 10s.; extra fine powder £48.

Boric Acid.—Per ton for ton lots in free 1-cwt. bags, carriage paid: Commercial, granular, £66; crystal, £73; powder, £70 10s.; extra fine powder, £68 10s.; B.P., granular, £79 10s.; crystal, £81; powder, £82 10s.; extra fine powder, £84 10s.

Butyl Acetate BSS.—£156 10s. per ton, in 10-ton lots.

Butyl Alcohol BSS.—£143 per ton, in 10-ton lots.

Calcium Bisulphide.—£6 10s. to £7 10s. per ton f.o.r. London.

Calcium Chloride.—70/72% solid £9 12s. 6d. per ton, in 4-ton lots.

Charcoal, Lump.—£25 per ton, ex wharf. Granulated, £30 per ton.

Chlorine, Liquid.—£28 10s. per ton d/d in 16/17-cwt. drums (3-drum lots).

Chrometan.—Crystals, 6d. per lb.

Chromic Acid.—1s. 10d. to 1s. 11d. per lb., less 2½%, d/d U.K.

Citric Acid.—Per lb., d/d buyers' premises, for 5 cwt. or over, anhydrous, 1s. 9d. plus 10%, other, 1s. 9d.; 1 to 5 cwt., anhydrous 1s. 9½d. plus 10%, other 1s. 9½d. Higher prices for smaller quantities. All subject to a trade discount of 5%.

Cobalt Oxide.—Black, delivered, 9s. 10d. per lb.

Copper Carbonate.—MANCHESTER: 2s. 4d. per lb.

Copper Chloride.—(63%), d/d, 2s. 7d. per lb.

Copper Oxide.—Black, powdered, about 1s. 4½d. per lb.

Copper Nitrate.—(63%), d/d, 2s. 6d. per lb.

Copper Sulphate.—£78 2s. 6d. per ton f.o.b., less 2%, in 2-cwt. bags.

Cream of Tartar.—100%, per cwt., about £12 12s. per 10 cwt. lot, d/d.

Ethyl Acetate.—10 tons and upwards, d/d, £114 per ton.

Formaldehyde.—31 per ton in casks, according to quantity, d/d. MANCHESTER: £32.

Formic Acid.—85%, £66 to £67 10s. per ton, carriage paid.

Glycerin.—Chemically pure, double distilled 1,260 s.g. 227s. 6d.—230s. 6d. per cwt. Refined pale straw industrial, 5s. per cwt. less than chemically pure.

Hexamine.—Technical grade for commercial purposes, about 1s. 4d. per lb.; free-running crystals are quoted at 2s. 1d. to 2s. 3d. per lb.; bulk carriage paid.

Hydrochloric Acid.—Spot, 7s. 6d. to 8s. 9d. per carboy d/d, according to purity, strength and locality.

Hydrofluoric Acid.—59/60%, about 1s. to 1s. 2d. per lb.

Hydrogen Peroxide.—1s. 0½d. per lb. d/d, carboys extra and returnable.

Iodine.—Resublimed B.P., 18s. per lb. in cwt. lots.

Iodoform.—22s. per lb.

Iron Sulphate.—F.O.R. works, £3 15s. to £4 per ton.

Lactic Acid.—Pale tech., 44 per cent by weight £130 per ton; dark tech., 44 per cent by by weight £110 per ton ex works; Usual container terms.

Lead Acetate.—White: £146 10s. per ton.

Lead Carbonate.—Nominal.

Lead Nitrate.—£133 10s. per ton.

Lead, Red.—Basis prices per ton: Genuine dry red lead, £155; orange lead, £167. Ground in oil: red, £177 10s.; orange, £189 10s.

Lead, White.—Basis prices: Dry English, in 8-cwt. casks, £162 per ton. Ground in oil: English, under 2 tons, £181.

Lime Acetate.—Brown, ton lots, d/d, £18 to £20 per ton; grey, 80-82%, ton lots, d/d, £22 to £25 per ton.

Litharge.—£155 per ton.

Lithium Carbonate.—7s. 9d. per lb. net.

Magnesite.—Calcined, in bags, ex works, £27.

Magnesium Carbonate.—Light, commercial, d/d, £74 5s.; cwt. lots £82 10s. per ton d/d.

Magnesium Chloride.—Solid (ex wharf), £15 per ton.

Magnesium Oxide.—Light, commercial, d/d, £187; cwt. lots £192 10s. per ton d/d.

Magnesium Sulphate.—£12 to £14 per ton.

Mercuric Chloride.—Per lb., lump, 10s. 8d.; smaller quantities dearer.

Mercury Sulphide, Red.—Per lb., from 10s. 3d. for ton lots and over to 10s. 7d. for lots of 7 to under 30 lb.

Methanol.—Pure synthetic, d/d, £28 to £38 per ton.

Methylated Spirit.—Industrial 66° O.P. 100 gals., 4s. 2d. per gal.; pyridinised 64° O.P. 100 gal., 4s. 4d. per gal.

Nickel Sulphate.—F.o.r. works, 3s. 4d. per lb. (Nominal.)

Nitric Acid.—£24 to £26 per ton, ex works.

Oxalic Acid.—About £146 per ton, packed in 5-cwt. lots, packed in free 5-cwt. casks.

Paraffin Wax.—From £58 10s. to £101 17s. 6d., according to grade for 1-ton lots.

Phosphoric Acid.—Technical (S.G. 1.500), ton lots, carriage paid, £67 per ton; B.P. (S.G. 1.750), ton lots, carriage paid, 1s. 2½d. per lb.

Phosphorus.—Red, 3s. per lb. d/d; yellow, 1s. 10d. per lb. d/d.

Potash, Caustic.—Solid, £88 10s. per ton for 1-ton lots; flake, £105 per ton for 1-ton lots. Liquid, d/d, nominal.

Potassium Bichromate.—Crystals and granular, 10⅝d. per lb.; ground, 11⅝d. per lb., for not less than 6 cwt.; 1-cwt. lots, ½d. per lb. extra.

Potassium Carbonate.—Calcined, 98/100%, £88 10s. per ton for 1-ton lots, ex store; hydrated, £81 for 1-ton lots.

Potassium Chlorate.—Imported powder and crystals, nominal.

Potassium Chloride.—Industrial, 96%, 6-ton lots, £16 10s. per ton.

Potassium Iodide.—B.P., 16s. 2d. per lb. in 28 lb. lots.

Potassium Nitrate.—Small granular crystals, 81s. per cwt. ex store, according to quantity.

Potassium Permanganate.—B.P., 1s. 7½d. per lb. for 1-cwt. lots; for 3 cwt. and upwards, 1s. 6d. per lb.; technical, £6 13s. to £7 13s. per cwt.; according to quantity d/d.

Potassium Prussiate.—Yellow, nominal.

Salammoniac.—Dog-tooth crystals, £72 10s. per ton; medium, £67 10s. per ton; fine white crystals, £21 10s. to £22 10s. per ton, in casks.

Salicylic Acid.—MANCHESTER: 2s. to 3s. 4½d. per lb. d/d.

Soda Ash.—58% ex depôt or d/d, London station, £8 17s. 3d. to £10 14s. 6d. per ton.

Soda, Caustic.—Solid 76/77%; spot, £18 4s. per ton d/d.

Sodium Acetate.—£49-£55 per ton.

Sodium Bicarbonate.—Refined, spot, £11 per ton, in bags.

Sodium Bichromate.—Crystals, cake and powder, 9d. per lb.; anhydrous, 9½d. per lb., net, d/d U.K. in 7-8 cwt. casks.

Sodium Bisulphite.—Powder, 60/62%, £29 12s. 6d. per ton d/d in 2-ton lots for home trade.

Sodium Carbonate Monohydrate.—£25 per ton d/d in minimum ton lots in 2-cwt. free bags.

Sodium Chlorate.—£52 to £57 per ton.

Sodium Cyanide.—100% basis, 8d. to 9d. per lb.

Sodium Fluoride.—D/d, £4 10s. per cwt.

Sodium Hyposulphite.—Pea crystals £23 2s. 6d. a ton; commercial, 1-ton lots, £21 12s. 6d. per ton carriage paid.

Sodium Iodide.—B.P., 17s. 3d. per lb., in 28 lb. lots.

Sodium Metaphosphate (Calgon).—Flaked, loose in metal drums, £114 ton.

Sodium Metasilicate.—£19 to £19 5s. per ton, d/d U.K. in ton lots.

Sodium Nitrate.—Chilean Industrial, 97-98%, 6-ton lots, d/d station, £23 per ton.

Sodium Nitrite.—£29 12s. 6d. per ton.

Sodium Percarbonate.—12½% available oxygen, £7 17s. 9d. per cwt. in 1-cwt. drums.

Sodium Phosphate.—Per ton d/d for ton lots: Di-sodium, crystalline, £36 10s., anhydrous, £73; tri-sodium, crystalline, £36 10s., anhydrous, £70.

Sodium Prussiate.—9d. to 9½d. per lb. ex store.

Sodium Silicate.—£6 to £11 per ton.

Sodium Silicofluoride.—Ex store, nominal.

Sodium Sulphate (Glauber Salt).—£8 per ton d/d.

Sodium Sulphate (Salt Cake).—Unground. £6 per ton d/d station in bulk. MANCHESTER: £6 10s. per ton d/d station.

Sodium Sulphide.—Solid, 60/62%, spot. £25 15s. per ton, d/d, in drums; broken, £27 5s. per ton, d/d, in casks.

Sodium Sulphite.—Anhydrous, £29 10s. per ton; pea crystals, £20 10s. per ton d/d station in kegs; commercial, £12 to £14 per ton d/d station in bags.

Sulphur.—Per ton for 4 tons or more, ground, £15 11s. 6d. to £17 16s. 6d. according to fineness.

Tartaric Acid.—Per cwt.: 10 cwt. or more, £15.

Tin Oxide.—1-cwt. lots d/d £25 10s. (Nominal.)

Titanium Oxide.—Comm., ton lots, d/d (56-lb. bags), £122 per ton.

Zinc Oxide.—Maximum price per ton for 2-ton lots, d/d; white seal, £172 10s.; green seal, £171; red seal, £170.

Zinc Sulphate.—Nominal.

Rubber Chemicals

Antimony Sulphide.—Golden, 2s. 5d. to 3s. 6d. per lb. Crimson, 3s. 4½d. to 3s. 6½d. per lb.

Arsenic Sulphide.—Yellow, 1s. 9d. per lb.

Barytes.—Off colour, ex store. Imported £13 10s per ton. Extra white bleached ex store, £16.

Cadmium Sulphide.—About 20s. per lb.

Carbon Bisulphide.—£65 5s. per ton, according to quality.

Carbon Black.—6d. to 8d. per lb., according to packing.

Carbon Tetrachloride.—£64 10s. per ton.

Chromium Oxide.—Green, 2s. per lb.

India-rubber Substitutes.—White, 1s. 9½d. to 2s. 3d. per lb. ; dark, 1s. 8½d. to 2s. 1½d. per lb.

Lithopone.—30%, £54 per ton.

Mineral Black.—£7 10s. to £10 per ton.

Mineral Rubber, "Rupron."—£20 per ton.

Sulphur Chloride.—7d. per lb.

Vegetable Lamp Black.—£49 per ton.

Vermillion.—Pale or deep, 15s. 6d. per lb. for 7-lb. lots.

Nitrogen Fertilisers

Ammonium Sulphate.—Per ton in 6-ton lots, d/d farmer's nearest station, £12 18s. 6d.

Compound Fertilisers.—Per ton d/d farmer's nearest station, I.C.I. Special No. 1, £20 14s.

"Nitro-Chalk."—£12 9s. 6d. per ton in 6-ton lots, d/d farmer's nearest station.

Sodium Nitrate.—Chilean agricultural for 6-ton lots d/d nearest station, £19 17s. 6d. per ton. Chilean industrial for 6-ton lots £23.

Coal-Tar Products

Benzol.—Per gal, ex works : 90's, 3s. 3d. ; pure, 3s. 5½d. ; nitration grade, 3s. 7½d.

Carbolic Acid.—Crystals, 1s. 1½d. to 1s. 3½d. per lb. Crude, 60's, 4s. 3d. MANCHESTER : Crystals, 11½d. to 1s. 1½d. per lb., d/d crude, 5s. 4d., naked, at works.

Creosote.—Home trade, 8d. to 10½d. per gal., according to quality, f.o.r. maker's works. MANCHESTER : 6½d. to 9¾d. per gal.

Cresylic Acid.—Pale 98%, 4s. 0d. per gal. ; 99.5/100%, 4s. 10d. American, duty free, for export, 9s. 0d., naked at works. MANCHESTER : Pale, 99/100%, American, duty free, 7s. per gal.

Naphtha.—Solvent, 90/160°, 2s. 10d. per gal. for 1000-gal. lots ; heavy, 90/190°, 2s. 4d. per gal. for 1000-gal. lots, d/d. Drums extra : higher prices for smaller lots. Controlled prices.

Naphthalene.—Crude, ton lots, in sellers' bags, £17 to £20 per ton according to m.p. ; hot-pressed, £50 to £60 per ton, in bulk ex works ; purified crystals, £60 to £70 per ton. F.O.B.

Pitch.—Medium, soft, home trade, 115s. per ton f.o.r. suppliers' works ; export trade, 120s. per ton f.o.b. suppliers' port. MANCHESTER : £5 10s. f.o.r.

Pyridine.—90/160°, 23s. per gal. MANCHESTER : 25s. to 28s. per gal.

Toluol.—Pure, 3s. 2½d. per gal. MANCHESTER : Pure, 3s. 2d. per gal. naked.

Xylol.—For 1000-gal. lots, 4s. 0½d. to 4s. 3d. per gal., according to grade, d/d.

Wood Distillation Products

Calcium Acetate.—Brown, £15 per ton ; grey, £22.

Methyl Acetone.—40/50%, £56 to £60 per ton.

Wood Creosote.—Unrefined, from 3s. 6d. per gal., according to boiling range.

Wood Naphtha.—Miscible, 4s. 6d. to 5s. 6d. per gal. ; solvent, 5s. 6d. to 6s. 6d. per gal.

Wood Tar.—£6 to £10 per ton.

Intermediate and Dyes (Prices Nominal)

m-**Cresol** 98/100%.—Nominal.

o-**Cresol** 30/31° C.—Nominal.

p-**Cresol** 34/35° C.—Nominal.

Dichloraniline.—2s. 8½d. per lb.

Dinitrobenzene.—8½d. per lb.

Dinitrotoluene.—48/50° C., 9½d. per lb. ; 66/68° C., 1s.

p-**Nitraniline.**—2s. 11d. per lb.

Nitrobenzene.—Spot, 5½d. per lb. in 90-gal. drums, drums extra, 1-ton lots d/d buyers' works.

Nitronaphthalene.—1s. 2d. per lb. ; P.G. 1s. 0½d. per lb.

o-**Toluidine.**—1s. per lb., in 8/10-cwt. drums, drums extra.

p-**Toluidine.**—2s. 2d. per lb., in casks.

m-**Xylidine Acetate.**—4s. 5d. per lb., 100%.

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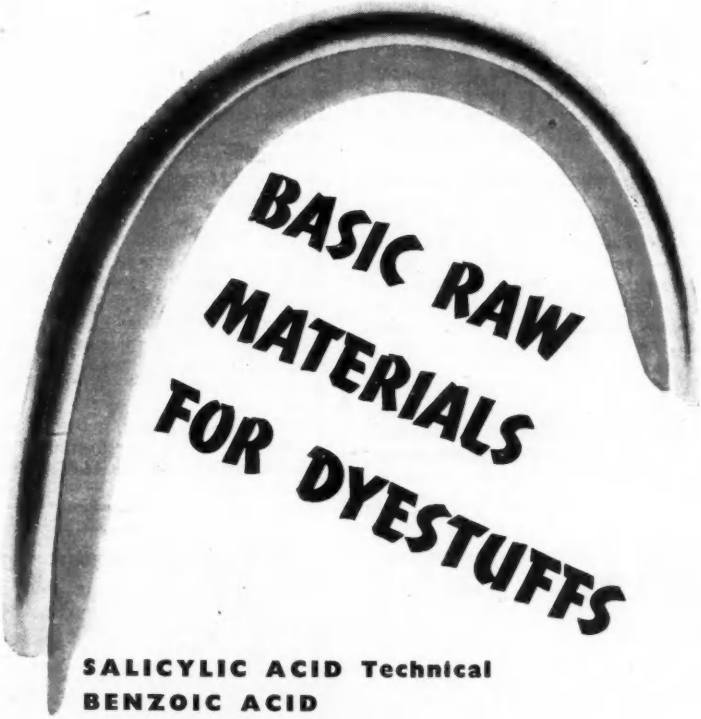

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Chemical & Allied Stocks & Shares

DESPITE Budget fears, stock markets have been inclined to strengthen, although in most sections the volume of business was moderate. Buyers were generally inclined to hold off until after the Chancellor's announcement, but on the other hand, dealers were impressed by the fact that so far higher taxation fears have not led to any very heavy selling.

British Funds rallied moderately and leading industrial shares were inclined to strengthen largely because they offer not unattractive yields at current prices on the basis of last year's dividends. It is being assumed that the tax increases will probably not be so severe as to make lower dividends; although they may aim at preventing higher dividends by increasing taxation on distributed profits.

Many factors are likely to influence earnings in the current year, notably rising prices and shortages of materials. The moderate rally in British Funds has been attributed partly to the view that later in the year a big Defence loan issue may be made, and that if this is planned the authorities might if necessary decide to provide official support for the gilt-edged market to prevent anv sharp fall in prices.

A definite move to higher money rates is anticipated by next year which would imply lower prices and higher yields for all classes of fixed-interest securities.

Chemical and kindred shares were better, partly because latest developments have aroused hopes that the sulphur supply position will not deteriorate further. Imperial Chemical have rallied to 45s. 4½d. at the time of writing, while Monsanto at 61s. 6d. have remained under the influence of the excellent results and bonus news. Albright & Wilson 5s. shares at 17s. 9d. were firm on further consideration of the financial results. Brotherton were 21s. 3d., F. W. Berk 2s. 6d. shares were 5s. 7½d. with the new shares 1s. premium over the issue price. Laporte Chemicals 5s. units were 10s. awaiting news of the expected new issue terms.

The U.S. announcement of additional supplies to aid the immediate sulphur shortage caused Courtaulds to firm up to 41s. 9d. and British Celanese to 27s. 3d.

United Molasses have rallied to 57s., and Turner & Newall to 91s., while Associated Cement at 92s. 9d. have also moved in favour of holders. Staveley were 86s., and Powell Duffryn 32s. 3d. Guest Keen at 54s. 3d. have been active on market talk of a higher dividend or perhaps a special return of capital arising from compensation for nationalisation of the company's steel interests.

Borax Consolidated at 65s. remained firm, and British Glues at 22s. became steadier. Boots Drug were 47s., and British Drug Houses 5s. shares 8s. 3d. Glaxo Laboratories at 59s. 3d. remained active on talk of higher dividend prospects. United Glass Bottle were quoted at 80s. 7½d., with Triplex Glass at 23s. 9d. British Xylonite were 80s., Kleeman 11s. 3d., De La Rue 25s., and British Industrial Plastics 2s. shares 6s. 6d. Among paints, Lewis Berger at 34s. 9d. were firm on the proposed 100 per cent share bonus.

Oil shares have been active, although at the time of writing, Anglo-Iranian have receded further on latest news from Persia.

U.K. Sulphur Requirements

TWO American experts in the industrial applications of sulphur are at present on a visit to this country to review the U.K. sulphur requirements.

Talks began on 27 March between Board of Trade representatives and the experts, Dr. F. J. Curtis, vice-president of the Monsanto Chemical Co., and Mr. E. B. Lopker, director of engineering of the Blockson Chemical Co., who are consultants to European Co-operation Administration. Plans will be discussed to encourage home production and reduce the demand for American sulphur.

Dr. Curtis and Mr. Lopker will also investigate whether any assistance can be given to speed up construction of plant to derive sulphur from alternative raw materials.

Britain has been granted 19,000 tons of sulphur to help meet the immediate shortage it was stated by the U.S. Department of Commerce. These supplies were part of a 30,000 ton supplementary quota for Marshall Plan countries and are issued as advances chargeable against quotas for future quarters of this year.

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CHEMIST aged 22-35 required of B.Sc. or A.R.I.C. standard for Organic Chemical Works near Birmingham. The duties include investigations on works processes and are varied and interesting. Applicants should possess initiative and persistence. A Contributory Pensions Scheme is in operation. Apply Box No. C.A. 3007, THE CHEMICAL AGE, 154, Fleet Street, London, E.C.4.

ENGINEERS with degrees in Mechanical or Chemical Engineering are required for The Bahrein Petroleum Company Ltd., Persian Gulf, who have openings for (*a*) men not over 40 years of age with three or more years experience in oil refining, coal tar or chemical distillation plants; (*b*) graduates with experience to train in various phases of their process, design and development work. Living costs are low the company providing free board, air conditioned accommodation and medical attention. Kit allowance, and provident fund. Write with full particulars of age, experience and education to Box 4035 c/o Charles Barker & Sons Ltd., 31 Budge Row, London, E.C.4.

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Applicants should have an Honours Degree in chemistry, physics or engineering, or associateship or corporate membership (as appropriate) of one of the recognised professional Institutes or Institutions. They must have had industrial production experience and be fully conversant with this class of work. The work is in a new field and considerable initiative, drive and organising ability is essential.

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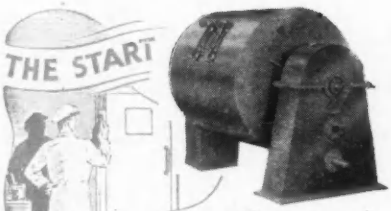

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